



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

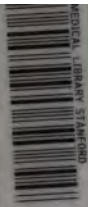
We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

0174 3737



TREATMENT OF
Chronic Forms of Disease.

By GEO. H. TAYLOR, M. D.,

Author of "Health by Exercise," "Health for Women," "Pain and
Herbal Therapeutics," "Manual Massage," etc. Consulting
Physician to The Improved Movement Cure Institute,
71 East 59th Street, New York.

Copyright, 1893, by THE IMPROVED MOVEMENT CURE INSTITUTE

NEW YORK:
GEORGE W. RODGERS, PUBLISHER.

1893.

U702
T24
1893

LANE



LIBRARY

COOPER LANE FUND

MECHANICAL AIDS
IN THE
TREATMENT OF
Chronic Forms of Disease

By GEO. H. TAYLOR, M. D.,

Author of "Health by Exercise," "Health for Women," "Pelvic and
Hemial Therapeutics," "Manual Massage," etc. Consulting
Physician to The Improved Movement Cure Institute,
71 East 59th Street, New York.

COPYRIGHT, 1893, BY THE IMPROVED MOVEMENT CURE INSTITUTE

LANE LIBRARY

NEW YORK:

GEORGE W. RODGERS, PUBLISHER.

1893.

D



CONTENTS.

THE POSTURAL OR "LIFTING" COUCH,

For Relieving Pelvic Affections—Mechanical,
Gynæcological and Medical.

THE CHEST DEVELOPER, - - -

An Apparatus adapted to Correct Thoracic
and to Restore Proper Function to the
Mechanism.

MASSAGE, - - - - -

Its Principles, Varieties, Factors and Adaptations

THERAPEUTICS OF SLOW MASSAGE, - - -

Auto-Massage—Kneading.

THERAPEUTICS OF RAPID MASSAGE, - - -

Its different forms and effects.

*

THE POSTURAL OR "LIFTING" COUCH
FOR RELIEVING PELVIC AFFECTIONS—
MECHANICAL, SURGICAL, GYNÆCOLOGICAL AND
MEDICAL.

PAGE 1

3

3.

5.

74

THE apparatus whose description follows adapted to raise and to sustain the contents of the pelvis, however depressed and confined by morbid adhesions; to re-establish and maintain an adequate outflow from the pelvis the venous circulation; and to increase such a flow to the extent required by pathological indications. The above-noted effects of the use of the apparatus will therefore indicate the fundamental nature and requirements of malposition and of errors of nutrition to which the various contents of the pelvis are notably subject, including those which too often prove intractable to medical skill.

The mechanism for attaining these ends is very simple, and requires only moderate tact for successful use. It is not a medium for presenting new ideas and principles, but for the successful application of those well established and undisputed in the realm of mechanico-physiology which have suffered neglect, and which are vitally important in their therapeutic application in different branches of the art of medicine.

The apparatus includes a li
 well-upholstered top, convenie
 the body in a lying position.
 sections. Two are hinged to the
 and admit of being lowered and
 a table, as may be required.
 head-rest; the other supports
 the head-rest is the *function*
 extends to the hips. It is hing
 ders, but free at the end supp
 that it admits of being pu
 a trap door. A lever at the
 extends by means of connectio
 of this section, so adjusted tha
 the section swings upward. T
 operator's foot causes the sec
 of the body resting upon it to
 with the horizontal that may
 remaining portion of the top o
 manently fixed to the frame.

Two principal uses are made
 both superinducing positive ;
 remedial effects. One passiv
 displaced organ or viscera c
 adjacent parts, and removes
 local circulation, both in the
 vascular parts; the other co
 and permanently to maintain t
 that is, restores the health of
 The *passive* method, and the
 ples it represents, will first rec

The patient lies upon the back, head resting on its supporting piece, *both hands bearing on the top (not the back) of the head, with fingers firmly interlocked*; the feet drawn up near the hips and firmly planted on the couch. Before proceeding further, it is indispensable that the physiological consequences of the position described be clearly understood.

The mechanism of respiration now operates without the least restraint, changing its twenty to thirty cubic inches of air fifteen to twenty times every minute, as before; but the anatomical parts engaging in the act are radically different. The raised arms cause tension of all the muscles attached to the humerus; this tension draws apart and increases the distance between the side walls of the chest; it also renders them immobile. The exterior of the chest can no longer participate in the respiratory act. The rhythmic changes of chest space now devolve on the diaphragm, with the co-operation of the abdomen. The fluctuations of chest-space involved by respiration now reach the exterior by way of the abdominal and the pelvic contents, and in no other way; and the same number of cubic inches of space is represented without loss at the inferior contour of the body that was previously at the chest exterior. Respiratory rhythm is therefore continued by another set of muscles.

One is readily convinced of the completeness of the transfer described. A moderate pressure of

the hand at the pubic region of the abdomen the respiratory motions to be seen and felt point—slightly increased by reflex in the while the exterior chest walls are motionless.

The next point of interest is the alteration of the abdomen. Lateral distention of the abdomen increases the circumference of the upper phragmatic portion of the abdomen two inches, and its space proportionally. This increase of space necessitates a *redistribution* of the contents of the whole cavity, including the lungs. These contents inevitably pass into the spaces provided, and retire from that previously occupied. The exterior shape changes to conform to the redistribution of contents. The contents of the whole cavity of the trunk, considered as a unit, are lodged higher up.

The way is now clear to see that the respiratory rhythm is indubitably *pump-like* in its effects accord with its action. The contents of the common spaces, abdominal and pelvic, engage in rhythmic oscillations of pressure. One now sees that the respiratory is natural and spontaneous in all healthy creatures—that motor and pressure are not confined to the chest, but tend through the whole cavity of the trunk. They are physiologically required for the movement of the contents of each division of the cavity. The effect of motor rhythm is its indispensable power. The respiratory movement

gaged, unite their power to elevate the diaphragm, thereby producing a tendency to a vacuum below it. The inevitable consequence is the urging upward of the whole visceral mass by atmospheric pressure. This effect is more readily seen when slightly increased—as by going up stairs with both hands pressing the crown of the head. The location and the interrelations of the pelvic contents, therefore, practically depend on the overlying mass, are subject in health to the motor changes of this mass, and are controllable through it.

Another indispensable effect of respiratory rhythm is its agency in returning the venous circulation. The organs in the pelvis, being devoid of muscles adapted to this end, are, in the absence of normal rhythm, as helpless as the contents of the skull, and inevitably suffer hyperæmia and its consequences, the proofs of which will appear further on.

Having thus presented necessary physiological data, we may proceed with the apparatus. The operator, standing near the patient's head, presses the lever with his foot. The force is transmitted to the movable section on which the



trunk lies. By the arrangement of levers and connecting rods this portion is thrown into an *inclined* position, the degree of inclination being always such as is agreeable to the patient. The body is next allowed to descend to the commencing position, and this act of raising and lowering the central part of the body may be frequently repeated, suspending it at the elevated stage.

Respiration and gravitation now unite their forces, and the weight of visceral organs and the power of the chest muscles are combined and extended to the contents of the pelvis, urging the latter *from* the pelvic cavity toward the spine provided at the other or upper end of the abdomen.

It being realized that the union of forces upward the contents of the pelvic cavity is and positive, and that the *direction* of suction is desirable, it may now be shown that *degree* may easily be increased to any extent required. The traction affecting local contents of the pelvis and vicinity, impelling them, may be made equal to any emergency. Additional force required to overcome gravitational resistance is secured by adding pressure from the hand of the operator. If during expiration the central mass be urged by the hand of the operator *from* the base of the abdomen, it is the force thus applied co-operates with the muscular power of respiration and suction of the mass. The added force

tatively applied and adapted to the therapeutic requirements, whether these require one or one hundred pounds, or more if needful, to overcome whatever resistance the pathological condition may present. The process is entirely passive and painless, may be varied to suit conditions and circumstances, and is incapable of causing disagreeable feelings or consequences.

The remedial utility of this class of processes may be thus summarized: It causes the physiological gliding of the peritoneal surfaces of contiguous viscera, a function for which they are adapted; and which is indispensable for their health. It elevates the overlying digestive viscera, thus providing the space requisite for replacement upward of the pelvic contents. This effect is an absolutely necessary preliminary to ascent and rectification of position and interrelation of parts of the pelvic organs, and the want of it insures practical failure of instrumental methods and of manual procedures, however deftly supplied. The same process causes progressive or rapid *divulsion* of morbid attachments, and inaugurates the natural gliding of peritoneal surfaces which obviates recurrence of fixation.

Even more significant, if possible, are the remedial advantages superinduced in the nutrition of the pelvic organs by the agency of the same and similar processes. Fluid constituents of a part are naturally more sensitive and obedient to physical impulses than masses are. The return

circulation from the contents of the inferior portion of the cavity of the trunk, and especially from the pelvis, physiologically depends on rhythm. The accessories of rhythm supplied by art have, therefore, inestimable remedial value. The physiological *drainage* (so to speak) of the pelvic contents is practically effected by this agency, and a defect or absence of rhythmic impulse plunges the pelvic organs into difficulties which are well-nigh the opprobrium of medicine. These organs are, in this case, in the condition resembling that of a submerged water wheel. The return of function depends on removing the back water. Accumulated local residuals of pelvic organs are removed through abundant venous outflow, for this is indispensable to absorption, and therefore to healthy nutrition.

Warned by practical failures of purely theoretic remedial devices, the medical man naturally (and commendably) desires corroborative evidence of the correctness of his statements. This he may have. Appraisal is not indispensable for the most searching and conclusive investigation. He should not only *know*, but positively *know*, the validity of the facts afforded, and be able to eliminate all possibility of misunderstanding or deception. *Hernia* fulfills the test requirement. The condition visceral displacement is not morbid fixation is extreme, peritonitis is rapidly degenerating. The real

pany me to the bedside of an actual patient, and, by noting procedures may *himself* secure as good results in any similar case, however grave. The following is one of repeated instances:

The present instance is that of a laborer, about fifty years old, belonging to the charity class. The physician, after prolonged, fruitless, and, I may add, injurious efforts to reduce the strangulated protrusion by taxis, called in the operating surgeon, who was prepared to seek relief by use of the knife. I was known by the latter to be near at hand, and was called in, probably not from the most commendable motives, as it was conceded to be a case of desperation, and would afford an extreme test of the value of my methods in this class of cases. I found the patient in extreme suffering; he was constantly retching and had been vomiting for several hours; had a strained and almost ghastly appearance, and was surrounded by weeping wife and children. The protrusion appeared to be of the inguinal variety at the right side, as large as one's fist, tense, shining, bluish. The patient was required to clasp his hands on the crown of his head, and to *keep* them in this position. Next, the wife's ironing board was slid lengthwise under his back, reaching his shoulders. His hips were raised ten or twelve inches by a prop under the board. Slight pressure at the pubic region indicated that the rhythm of respiration now included the lower abdomen. This motion was gently increased in extent by the assistance of pressure during expiration. This part of the abdomen gradually flattened. Taking advantage of this fact, the compression of my hands, united with stroking toward the diaphragm, worked something of a local concavity. This facilitated a more vigorous engagement of my hands with the abdominal mass, enabling me to *push* in co-operation with the muscular strife thus superinduced. The motor *push*, as relates to the diaphragmatic direction, includes the whole mass, and is a *pull* as relates to the

inferior boundary of the cavity. It was directly seen that decided traction was made on the interior portion of the entrapped loop of intestine and omentum. The tension was made certain to touch by placing the finger properly at the constriction. Retching now ceased, and calmness replaced the agonized expression. My medical associates pointed to the changed appearance of the tumor—whose glossy, tense surface had become dull and covered with minute lines or wrinkles. The fluid contents of the sac were making their way through the constricted neck. I had charge of the case about half an hour, and gave proper directions for accelerating the returning process after its advance to a suitable stage, which, however, were not followed. The surgeon called at my room the next morning to say that the reduction was completed in the night, that no other attention had been bestowed, but to see that the prescribed positions were maintained (which gave not the least fatigue), and that the patient was well. Much less time would probably have been sufficient if the process had been properly assisted at the pillars of the canal. A truss or other support is required for after treatment in these cases, whether acute or chronic.

A proper understanding by physician of the mechanico-physiological principles connected with pelvic affections (including in this term the anatomical contents of the cavity) is indispensable that I hope to be pardoned for making superfluous explanations. Pelvic manifestations in and near the pelvis are being treated as if composed chiefly of solids, indeed they are. Solids offer resistance in dimensions—a consideration which is neglected in the case of fluids. These fluids exert the slightest impulse, because the infl-

CHRONIC FORMS OF DISEASE

may be impelled, though an entire mass is incorrigible, but not be. The mass is incorrigible, but these and similar cases it is only necessary to induce a *difference of pressure* in the cavities connected by the hernial neck. *fluid contents inevitably pass in the direction of least resistance.* The conditions available for securing difference of pressure are clear: Exterior to the neck are fifteen pounds per square inch of atmospheric pressure on the sac; interior, the pressure is diminished by the force represented by the diaphragm acting as a broad piston by means of its own and associated muscles, assisted by practically reversed, and re-enforced by compression from the hand, the whole of which, acting in the same direction, takes effect at the point of confinement. However pinched or vitally deteriorated, the tissues are still wet at the constriction, and the independent molecules yield in countless, minutest streams throughout its sectional area, and speedily transfer the pent-up fluids to the interior abdominal vessels.

The same mechanico-physiological principles have equal application to the whole inferior end region of the trunk. These principles are independent of considerations of sex, anatomical structure, form, substance, multiplicity.

gree of nervous irritability of the special organs to which they may be applied.

The provisions incorporated in the organic mechanism for securing a continuous and abundant outflow from the pelvic organs are ample to the point of superfluity and equal to the most trying emergencies. We have called this function physiological *drainage*, the better to suggest the ill consequences certain to arise from its inadequacy, the most important of which consists of qualitative degeneration of the retained superfluous local ingredients. The plain therapeutic indication, whatever be the morbid stage, is to submit *all* localized ingredients to the organic chemistry, through the agency of the circulation.

In the light of the above statements of principles, the stumbling-block of pelvic therapeutics becomes apparent. It is the assumption of mechanico-physiological functions which in the vital organism may be neglected or ignored, in favor of theoretical substitutions. More plainly, efforts are made to locate and maintain the uterus and its appendages in positions already pre-empted, so to speak, by the digestive organs, innocently regarding the necessity of first elevating the overlying viscera. It is further assumed that dislocations and displacements of parts of the pelvic contents are amenable to mechanical correction, while stray masses of omentum and of the digestive tube continue to crowd and oppress the accused, but thoroughly innocent, pelvic organs.

Even more unjustifiable and injurious are the assumptions respecting the fluid contents of the pelvic organs. Therapeutic ingenuity is exercised without limit in devising impracticable and evanescent ways of disposing of offending local residual fluids, while the natural venous outlets remain unemployed, and when, as shown, only the feeblest mechanico-physiological preponderance is sufficient for the thorough drainage of the whole pelvic region.

The *second* of the two principal uses of the postural or "lifting" couch is adapted to secure *permanency* for the effects above described. Permanency of therapeutic effects is acquired by *incorporating* such effects, so that they become the standard and continuous physiological condition. The mode of so directing the ordinary physiological processes as to achieve most notable therapeutic results is typified by the active and *semi-active* process for which the apparatus is adapted.

In this process the patient assumes a position on the couch exactly the reverse of that before described; his feet are near the standing place of the operator, his face looking down, and he rests upon his elbows, which must be perpendicular to his shoulders and at such a point as will bring the middle portion of his thighs to rest on the well-padded, free end of the hinged part of the apparatus. Care is required to maintain unmoved the points of support at the elbows and

the thighs, for the mechanical effect of the process depends on this.

The operator, with one foot upon the lever, grasps the limbs of the patient in the vicinity of the ankles; he then presses down the lever with



his foot, and simultaneously draws the body backward and upward to correspond with the same motion communicated to the body from the hinged part of the couch. The limbs of the

patient, if a woman, are closely wrapped in skirts and a shawl. The angle of elevation shown in the cut is extreme and seldom necessary. The shoulders and hips may attain same level, or the latter may become transverse a little higher.

The following mechanical consequences may be noted. The abdomen, unsupported, assumes the form and functions of a pouch, in which the viscera descend by their weight. The viscera, being continuous and in juxtaposition with the abdominal, necessarily retain the same direction, aided by atmospheric pressure. So far the process is passive. The body

upward motion of the trunk, while the elbows are fixed, pulls the arms in the same direction, causing them to become parallel with the trunk. This act produces extreme muscular tension and renders immovable the side-walls of the chest, and expands the diaphragmatic region to an extreme degree. This distension produces no void space, for the contents of the whole cavity move toward and fill it, causing corresponding shrinkage at the lower end. The pelvic contents necessarily recede as far as their normal connection with the pelvic walls will allow; morbid adhesions, should they exist, are, however, *first* subjected to the whole strain.

As in the position previously shown, respiration is not restricted, but, on the contrary, its scope is increased, since gravitation is changed from an impediment to a direct assistance. At each rhythmic act the contents are subjected to a vigorous *pull* down the sharp incline of the pendulous abdomen. The process may be repeated a number of times.

The forces which are made to combine in changing the location of the pelvic mass and the viscera of the lower abdomen, and in sundering impediments to the change, may now be understood at a glance. 1. Gravitation of the viscera, practically reversed. 2. The conversion of the diaphragm into a broad piston, having an area of something like one hundred and fifty square inches, whose slightest motion takes effect with

great power in co-operation with air pressure in detaching adhesions at and the inferior portion of the cavity. 3. Increased extent of respiratory rhythm using the whole power of the act in drawing the pelvis. To the above may be added following adjuvants: 4. Reflex contraction of the abdominal muscles, secured by placing the hands of an operator on the abdomen of the patient during the process. 5. Concentration of the mind in diminishing the time—that is, by a *quick* instead of *slow* execution of the process—converting the pelvic pull into something approximate to a pump-like function for securing *divulsion*. 6. Prolongation of the process at its stage of elevation, thereby increasing the advantages of repetitions by concentrating and multiplying its effect on the pelvic region. 7. The energetic co-operation of the *will* of the patient in the execution of the process, thus vastly increasing the described effects. 8. Allowing the patient to remain on the couch for some time after the process, lying face down, arms extended to the sides of the head, and in a position of rest with the body. Continuance of this process, continued expansion of the diaphragm, continued extension to the pelvis of the pump-like function of rhythm.

The process described insures the relief of the pelvic organs of excess of fluid, as well as vascular, degenerative

mal. In the vital organism, chemico-physics are controlled by motor physics; the former are incorrigible when the latter is persistently defective.

The *last* described function of the postural couch establishes and renders permanent the mechanical effects so plainly secured by that *first* described. In other words, most desirable mechanical effects are rendered physiological and indefinitely continuous—the highest aspiration of therapeutics. This consequence arises from directing and concentrating the full force of the organic energies on mechanico-physiological processes, whose previous defects are the fundamental source of both malpositions and disease of the pelvic contents. The processes aided by the couch conclusively prove the nature of the greater number of pelvic affections. There can be no better evidences of the nature of a cause than the prompt disappearance of its effects on removing the cause. These processes also typify the nature of the cultivation required. Other and similar processes, executed without the aid of the couch, are effective in the same direction.

We may now briefly recapitulate the uses of the postural or “lifting” couch—uses which also extend to other mechanico-physiological processes adapted to similar ends:

1. The highest function of the apparatus is *educational*. Its use quickly develops and es-

establishes beyond cavil ætiological facts dominating the surgery and of the pelvic and contiguous abdomen. Its scope includes not only the uterus, tubes, ligaments, and connective tissue, their blood-vessels and interstitia, but equally includes the rectum, its vesical floor, and the base of the pelvis. It affords physicians facilities for the accuracy of the statements of mechanical principles above explained, vindicating the author of inaccuracy according to them the merit to which he is entitled.

2. It establishes remedial principles in strangulated hernia, effective in moribund. It shows the practical management of moving chronic hernia, even when irreducible and held by adhesions. It shows that trusses, or other supports are not the treatment.

3. It establishes the principles of uterine sustentation, which includes the management of retro and other flexions, and of various placements. All so-called supports, internal and external, are superfluous. This remedial principle is continuous and permanent sustentation through proper cultivation and development of the natural *functional* support.

4. The same apparatus indicates

method of securing effective and complete physiological *drainage* of all organs within the pelvic cavity, whatever be the pathological form of the consequences of defect of this function. The methods pointed out for securing this purpose are effective in all varieties of hæmorrhoids and other morbid states of the rectum, in varicocele and hydrocele, in ovarian and uterine tumors, as well as in malpositions and minor troubles of the female organs.

5. It is important to keep in view the combination of mechanico-physiological operation which conduce to the radical curative effects mentioned. Respiratory rhythm is extended into, and its extent or play is increased in, the pelvis. The gliding of organs and parts due all serous surfaces is secured. The pelvic contents are subjected to fifteen or twenty alternations of pressure every minute constantly, affording the spontaneous *massage* normal to the parts. The venous vessels are subjected to incessant organic *aspiration*. Morbid as well as normal interstitial outflow results from the operation of the same mechanico-physical law. Deteriorated local fluids are submitted to the chemistry of the whole organism. The higher aims and more radical purposes of pelvic therapeutics are served.

THE CHEST DEVELOPER

AN APPARATUS ADAPTED TO CORRECT THORACIC
AND TO RESTORE PROPER FUNCTION TO THE
MECHANISM.

IT IS well known that the mechanical function of the chest is far in excess of its function; that the twenty or more cubic feet of air exchanged at each respiratory act is easily increased by vigorous exercise, voluntary effort, and by other means to ten times that amount. Nature provides a very large excess of capacity for breathing function beyond its ordinary use for emergencies. This surplus is highly valuable in therapeutics.

It is also open to observation that the motion of the chest incident to the respiratory act is not necessarily uniform in all parts of the chest. A variety of causes, such as habitual position, nervous defects, disease, may restrict muscular power, and the participation of some portion of the respiratory act, while other portions are frequently forced to engage in excessive expansion. For example, the greater expansion of the whole, of the change of air space at the right or the left side, at the top

tom of the chest, while the remainder participates but little, perhaps not at all, in the process.

These statements are confirmed in several ways. The most abundant and conspicuous instances are of the pathological order. Disease of a portion of the lungs partly, sometimes wholly, excludes respiratory changes in the diseased portion, a fact easily recognized by defect or absence of motion of the chest-walls over the diseased site. In deformities of the chest and spine the air change in the convex or bulging portion often greatly exceeds that of the shrunken part. Finally, it is well known that certain vocations and certain prolonged, fixed positions of the body, which involve excessive use of a part of the muscles of the chest and restraint of other muscles, are certain, when sufficient time is given, to produce unequal development of chest space and of the chest walls which control the chest space.

Now, the fluctuations of chest space, whether normal or otherwise, are produced solely by the mechanical movements of the walls which inclose the space. The instances above noted of irregular and partial expansion of the chest may be due at times to excessive actions of local muscles, but it is more generally due to *defective* action and deterioration of power of some part of the respiratory mechanism. In some one direction or other there is partial, perhaps complete, inhibition of natural respiratory movement; this indicates loss or defect of the power which moves, involving both

the involuntary and the voluntary contraction.

This condition is clearly *abnormal*. If the fault is functional only, or is associated with well-developed pathological features, it is outside the scope of medicinal remedy. The ablest physician finds himself confronted with pathological phases of the gravest kind in which ordinary remedies have no adaptation. He may medicate the diseased lung, but he cannot overcome the absence of motion of the overlying chest wall. The default of which prevents the "cure" from doing any good? In case of deformed chest, how are the shrunk and useless ribs on the flattened side to be restored under the defective functional movements of the chest wall?

The therapeutic indications are clear and distinct in the nature of the defect, whether regarded as purely functional or as having specific pathological forms. It is plain that the mechanical phase of the defect of direct extension of chest movement admits of radical aid and re-enforcement. Such aid is frequently invoked, but generally in so circumstantial and inadequate a manner as to practically defeat its specific purpose.

The *inferior* wall of the chest has few direct physiological relations than its lateral wall. It follows that corresponding extensive and complicated pathological consequences

defects of function of this part of the chest walls. This is because while side walls are exterior boundaries, the inferior is not. Instead of beating against the air, its motions, in respiration, are propagated through the visceral mass in reaching the bodily exterior. It is reasonable to infer that this mechanical arrangement is an indispensable part of Nature's plan in the physiological system; that defective function of the inferior wall and the insufficient motor waves in visceral parts, at least border on pathology and superinduce decided pathological consequences. To show that this defect of function, as well as its consequence, is remediable by means direct and unequivocal, is therefore of unbounded therapeutic importance.

The instrument of which a description follows is adapted to serve the several purposes above noted in a therapeutic degree. This will appear from a description in detail of its parts and mode of action.

A standard or post, as shown in Fig. 1, having an upward extension by means of a slide and ratchet, is fixed to the floor. The top of the sliding part bears a short, horizontal pad, B, for adjustment to and support of one's back or side. The acting part of the instrument is the pendulum, A, pivoted to the standard, opposite the pad. The weighted end of the pendulum just escapes the floor in swinging. A lever, C, bearing the transverse handle, D, is ratcheted to the pivoted

end of the pendulum, and may
pendulum at any angle, accord
of the patient, and also to th
stretched hands.



Fig. 1.

The *action* of the instrument
physiological and consequent
thereby secured may now be re
After adjusting the pad to ti
the shoulder blades and the h
that it may be comfor
patient imparts a

which causes the pendulum to swing backward, the weight rising in the arc of a circle, whose radius is the length of the pendulum, to an extent proportioned to the impulse. The force of gravitation immediately returns the pendulum, and, acquiring momentum equal to the impulse, it passes the perpendicular and describes another arc in front equal to that behind. The forward extension of the swing carries backward the lever, hands and arms, with considerable force. In this process the pad is made a fulcrum, over which the chest is bent through the leverage afforded by the extended arms. The momentum of the falling weight is so much force expended in whatever muscles are exposed to the action. It is evident that by placing one side instead of the back against the pad, and grasping the handle with one instead of both hands, the effects will be received by one lateral half in place of the whole anterior portion of the body. In many cases this use of the instrument is to be preferred.

After the first impulse is given, the pendulum continues to swing almost independent of effort. The action is non-fatiguing, imparts only agreeable sensations, and one is inclined to continue its use indefinitely.

The mechanico-physiological effects may now be briefly analyzed. The tension of chest muscles and tendons caused by the returning swing mechanically urges apart the side walls of the chest, and thus increases the circumference to the extent

for the process without inordinately increasing waste. It is therefore adapted to the feeble—to any one, child or adult, who can, by the help of the handle, maintain the erect position. The muscles are *pulled* by the swing of the pendulum, and nutrition therein is superinduced.

Suppose, for example, it is desired to correct thoracic symmetry with or without curvature. The bulging or overdeveloped side of the chest is applied to the pad, while the hand of the opposite or shrunken side grasps the handle and causes the pendulum to swing. The muscles related to the defect are set in action, the tendons are made tense, the side wall of the chest is drawn out, the ribs assume a more obtuse angle with the vertebral column, the local chest space is increased and is filled out by expansion of the previously contracted portion of the lung. The sequences ultimately appear in gradual but permanent correction of deformity of chest and through the rehabilitation of lost powers.

The *time* factor of the process should be appreciated. The action of the pendulum and its effects are completed by a return swing. Each excursion is performed in accurate, uniform time. Neither effort on the part of the patient nor the lack of effort, causes the least variation of the time-rate. Now, it is interesting to note that this rate corresponds with that of the normal respiratory rhythm. The consequence is that the motion imparted to the inferior

and the involuntary motion of respiration, fall together; they are conjoined in one act—the same act. The instrumental and the physiological processes, both involuntary, become merged and inseparable. It follows that the use of this, or a similar form of apparatus, serves to cultivate the respiratory mechanism, restores its natural degree, and raises its efficiency to the physiological standard.

Of even greater therapeutic significance is the change which is easily and surely superinduced in the *direction* of the respiratory movements by the use of the instrument. This effect has above been shown to be due to the more or less complete fixation of the side walls, compelling extreme functioning of the *inferior* or diaphragmatic wall of the chest. The consequence is extension of respiratory rhythm in the axial, instead of the transverse, dimension of the trunk. The respiratory wave now penetrates all the viscera, including those of the pelvis, and the movements of the inferior chest wall are wholly represented at the anterior abdominal and inferior pelvic boundaries.

The visceral mass in the cavity of the trunk, including that of the pelvis, is, through the operation of the forces described, subjected to *vertical rhythmic oscillation* to an extent corresponding with the swing of the pendulum, for the *depth* as well as the direction and time of the act is now controlled by the instrument. The

patient can, however, vary the degree of the act at will to suit his desires.

The vertical motion superinduced includes the contents of the venous blood and lymphatic vessels of every size. It is decidedly and powerfully *aspiratory* in relation to these vessels. The least upward motion of the inferior wall of the chest produces a difference in the degree of compression between the proximal or upper segments of these vessels and their distal segments. An upward flow of their contents is therefore a mechanical necessity. The return flow continues synchronously with the respiratory impulse and is proportioned to its extent. The constant repetition of the impulse, modified by the vascular elasticity, insures continuous flow, and practically and promptly extracts all fluids entering these vessels.

The portal division of the venous circulation enjoys the advantage of being more exposed to compression from combined muscular contraction and atmospheric pressure, and the use of valves is therefore unnecessary. The mechanism of the combined aspiration and compression and their effects are of such therapeutic value as to justify being somewhat dwelt

Physiologically, the expansion of the chest coincident with the contraction of the lower abdominal and pelvic spaces is but a mechanical tension which distends the inferior

being continued below the diaphragm, produces contraction or tension, which *diminishes* the subjacent abdominal space. The space at the *upper* part of the cavity is increased while that at the *inferior* part is proportionally diminished. The contained mass is necessarily urged by this act *into* the freer space above and *from* the narrowed space below.

The therapeutic importance of understanding the functions of the inferior wall of the chest requires that it be properly understood, for thereby much of the local medication so freely bestowed on localized diseases of these organs may be obviated. Further explanations and illustrations of the principles involved may therefore be justifiable. It is not necessary to imagine that the whole column of venous blood and lymphatic fluids are directly lifted to the chest, or that the vessels are squeezed like the bulb of a syringe. It is only needful to reflect that respiratory rhythm produces a series of *lowered resistances* toward the chest; that even minute differences of pressure between the proximal and distal segments of these vessels determine the direction of the flow of their contents, and that this is secured by the respiratory mechanism, acting through the inferior wall of the chest; and that not the least important of the functions of this mechanism is to secure complete, uninterrupted, and never-failing drainage of the pelvic viscera under all circumstances of health and of local

disease of any of the pelvic organs. It is seen that any gain at the thoracic segment the conduits for fluids secures movement of contents of the whole line. The minutest most distant pelvic capillaries are, in he constantly subjected to the mechanism and effectually and completely removes all superfluous contents of whatever nature. This physiological provision obviates local accumulation of fluids, stagnation, surrender of vital control to the chemical degeneracy that would otherwise be inevitable. The utility, indeed the necessity of assistance for securing these ends, by a typified by the instrument whose operation above described, is obvious.

The *grosser* therapeutic uses of the instrument are therefore the correction of misdirected respiratory rhythm, the consequent drainage of pelvic organs through physiological channels and the submitting of local morbid influences to the organic chemistry through the circulation.

The radical therapeutics of well-defined pathological states in advanced stages of development is practical extension of the same agency. It may safely take the purpose of the therapist as pointing out the true indication. He uses such means as will move some local superfluity, excess or degeneracy. Now, this something to be removed exists as a local concrete entity or antecedent defect of the mechanic

physics of the vital organism, as related to pelvic organs. The consequence is, local residual ingredients, in process of chemical deterioration.

The turgescence of the parts proclaims defective outflow of interstitial ingredients into the capillaries permeating the diseased mass. But outflow from tissues is infallibly assured by vascular onflow, for the superficial area of capillary walls is far greater than their transverse area. It is therefore plain that *absorption* is proportionally in excess of inflow from the arterial side, when the conditions above defined—viz., aspiration and contraction accompanying the rhythm of the inferior wall of the chest—are present.

The principle involved in local imbibition by returning vessels is well illustrated in Liebig's writings, in the experiment of causing water to flow through a segment of fowls' gut, arranged to traverse a vessel filled with water. It is shown that the *whole* of the water exterior to the animal membrane penetrates it and joins the outflowing stream. The conditions which control the emergence of interstitial fluids of the pelvic organs are similar to those above referred to. The pelvic tissues may be drained completely by employing the physiological mechanism adapted to secure venous outflow. The means pointed out only need to act with sufficient persistency, and, perhaps, to be slightly exaggerated, to comply with the most urgent thera-

MECHANICAL AIDS IN

eutic demands and become fostered by adacultivation into a habit.

To amend the vito-chemical deterioration an important organ is always a perproblem for the therapist. This pro' greatly simplified by the energetic o: superinduced by the processes of the insdescribed. A larger proportion of residuals become oxidized to the emerge. Imperfect products of waste, obstru inimical ingredients, are rendered blannocuous under the suitable degree logical oxidation. This, in fact, is pensable condition for health; and the of the oxidizing function is obvious for successful therapeutics. The cu that is being constantly reproduce vance very rapidly, however suita' may otherwise be.

The aid afforded by the instrum general, *but reaches, with ther* the diseased tissues. For arteri abundance of oxygen both in loose combination, readily pa ment in favor of *unstable ing* contact occurs. This is the of maintaining, therefore of integrity. Unstable, *noxiou* normally reduced to innocue wherever in the vital sys had.

This therapeutic end is secured by simply causing arterial blood to pervade the diseased parts. Indispensable to this object is the venous and lymphatic outflow, easily and thoroughly secured by the process which has been detailed. It is hence seen that healthy local nutrition, in distinction from perversion of the nutritive process, and the removal of local impediments thereto, are in a sense identical. Nature's provisions for maintaining the health of the pelvic organs and tissues in male and female are physiologically abundant; her provisions for restoring health which inhere in the physiological mechanisms appear to be equally ample. It is due that these parts be the healthiest of the vital organism. It only requires that this inherent mechanism and its uses be better understood by those whose profession and interest lie in that direction.

MASSAGE :

ITS PRINCIPLES, VARIETIES, FACTORS AND ADAPTATIONS.

THE resources of mechanico-therapeutics and its applicability in chronic affections are by no means exhausted in the statements of principles and practice already shown. Even more valuable adaptations of the same remedial agent are available for physicians inclined to investigate this department of medical practice. Not only abdominal and pelvic, but numerous other forms of chronic suffering, local and general, have been and may be successfully treated by careful adjustments of this class of remedies. Mechanical remedies in the sense implied in these articles are agents of power; and misconception of their physiological and pathological relations leads to their misapplication. It is, therefore, important that their nature and effects in different circumstances presented by disease be carefully investigated, to avoid errors and to secure the advantages this class of resources is capable of affording.

The department which seems next in need of attention has been used to some profit, but in a fragmentary manner, under the name of massage. The processes coming under this department appear simple only because their va-

justments to varying and diverse pathological states are not well understood. It therefore becomes necessary, first, to consider the nature of the factors of massage, so as to determine the suitability of each of these for correcting certain morbid states of the vital system and its parts.

Massage is popularly understood to be *pressure with motion* imparted to the person of an invalid for remedial purposes by the hands of a competent individual, hence called an operator or *masseur*. In its ordinary application the *direction, degree or force, extent, time, rate* and other particulars which are necessary factors of the process, are left to chance and receive little or no consideration, as though of no value. But, since these are susceptible of almost unlimited varied proportions to each other, it is clear that either may preponderate and, by giving character to the process, may greatly influence, or even control, the physiological effect, and therefore its suitability as a remedy. For example, massage may be confined to any special region or location; may be slow or quick; superficial or deep; prolonged or short; applied to chest, abdominal viscera, muscular parts, or skin; may give precedence in order of processes to any particular part or functioning department; and in each case its suitability for a given case may vary from perfect adaptation to extreme unfitness and even hazard. Massage, to be entitled to the appellation of remedy, must

therefore comply with the varying needs of chronic infirmities.

We may now follow the combination of pressure and motion from the hand of the operator, and note what becomes of it in the vital organism of the patient. For purposes of identification, we may call it *motor energy*—energy in the motor form. Motor energy is transmitted to the vital tissues and the fluids which pervade them in the form of *waves*, whose length and depth are determined by the amount of pressure and extent of motion the hand affords. But it no longer remains motor energy; neither is it lost or even diminished, force or energy being in its nature indestructible. It simply assumes other forms, which, together, are the exact equivalent of that transmitted, and which has its source in the mechanico-vital tissues of the operator. The changes of form are wrought by qualities which inhere in the receiving medium, and are partly of the mechanical and partly of the vital or *function-producing* order.

The motor area is a blended mass of non-vital, fluid and semi-solid, elastic and non-elastic, stable and unstable ingredients, and these is enriched by an accession of energy. Each disposes of in accordance with its physical constitutions and relations. The accession of energy assumes the form of pressure, and thus re-enforces that pressure on whatever part receives it. The addition

derived from exterior sources reappears in cognizable form in the physical phases of function, contributing to the highest physiological purposes of the organism. We will next see just how manual massage becomes therapeutically useful.

The *pressure* or compression of the hand displaces the fluids under it, whether these be vascular or interstitial. Following lines of least resistance, these fluids are urged along channels anatomically provided: the pressure, therefore, merges with the natural impulse which impels blood and other fluids, and removes both functional and mechanical impediments, whose presence detracts from health. Massage supplies motor force to render the physiological impulse equal to its purposes.

When some degree of adhesion exists between surfaces of objects, however minute, if impelled at different rates of motion, resistance, in the form of *friction* and of *elasticity*, appears. At the same time the motor energy expended is freely transformed to heat energy, as when two sticks are rubbed together, or a piece of rubber is stretched. The vital organism is an extensive area for this mode of transformation, and its operation is constant. The physiological provision for disposing of excess of heat renders its morbid accumulation from this cause improbable, perhaps impossible.

The forcible contact and collision of the minutest ingredients of the organism is an inevitable con-

sequence of the reciprocating form of massage. The endings of the motory excursions are comparable to blows of infinitesimal hammers. It follows that the minutest components of the motory area suddenly receive accessions of energy, quickening and increasing that previously inhering therein. The diverse elemental parts are affected by this cause in varied degrees. The free oxygen present readily participates in the new influence, and rearrangements of atomic constituents or *chemical* changes are rendered inevitable. The new chemical products contain more oxygen and are more stable; at the same time energy of some form has been liberated.

The absorption of motor energy for the purpose of converting unstable organic ingredients of the organism to stable chemical forms appears to be a leading purpose of the physical plans of life. In health its spontaneous introduction is sufficient to secure this end. But treatment by motor energy or massage, in case of injury consequent upon ill health, supplies the deficient chemical energy, and the vital organism is enabled to imbibe the oxygen required to oxidize and discharge ingredients which would otherwise immediately become prejudicial and fatal.

It is hence apparent that the order of composition of nutritive ingredients in the progress in the vital organism depends upon the motor energy coincidently developed. The chemical phase of physi-

innocuousness and final dismissal from the system of all its superfluous ingredients of whatever quality, even though such quality may have been the consequence of such adverse circumstances as have lessened the usual predominance of chemical activity, and even though deteriorated chemical products may have accumulated to a considerable amount.

Judging from the usual character of ordinary remedies, *chemical* energy is what is chiefly expected of them. The relations which drugs sustain to the morbid function, and especially to morbid effects and products, is the leading consideration in their selection—that is, in therapeutics. Traditional medical practice, therefore, yields its tacit approval to the chemical phase of massage. And this is not all. The medical profession has always freely used changes of temperature (heat-making) in its most convenient forms as a remedy, and in modern times frequently employs electricity, which is well known as an equivalent, derivative and convertible form of motor energy, for the same purpose. These facts appear to countenance and even afford cumulative approval of the remedial use of direct adjustable supplies of the same agent through massage.

The ultimate purpose of all remedies is simply to support the *vital* manifestations, and coincidentally to remove impediments thereto. By vital manifestations is understood the growth of or-

ganic structures, their reproduction in compensation for their waste; and more particularly the support of those changes in organized tissues from which proceed the special forms of energy which characterize the individual—namely, the varieties of *nervous* and *muscular* power.

These vital forms of energy are the product of *vital cells* and the result of the complex processes of *nutrition*. The direct purpose of the physical modes of energy into which motor energy is plainly resolvable is to provide the conditions indispensable for nutrition. Motor energy transfers ingredients to and from the vital cell; heat at an unvarying standard is indispensable for the required transformations, while chemical energy steps in to diminish the latent store of the vital cell, which, liberated, assumes the form impressed upon it by its organic instrument or tissue.

The nature of the assistance which massage affords to the struggling purposes of the organism through its influence on the changes due to the contents of the vital cell is therefore fairly intelligible. This recourse compensates in a manner for the preceding conditions. Very prominent causes of defective health are faults of special physical activities. Some parts and sections are overworked, others are insufficiently active. Massage supplies action in the place of auto action. By the latter the different parts of cell life, however diverse in function, are affected in equal degree, so that pre-existing

function are preserved. This is health. Ill health is a proclamation of differences, so that the necessary balance of functions is lost. The nutrition of important parts—as, for example, the respiratory or any other special mechanism—declines, and objective local consequences necessarily appear, demanding redress of therapeutics.

Now, massage acquires its value, which is truly remedial in distinction from hygiene, by its *adjustability*, by which it becomes adapted to diverse and often opposing pathological conditions, even when these have attained an extreme development. These apparently opposite effects are attainable by giving judicious preponderance to one or another of its separate and distinct factors. For, as before shown, massage is a *composite* agent. It unites pressure or *force*, which is susceptible of great variability, with *motion*, whose *rate* or velocity also admits of infinite variations. The factors largely controlling the effects of massage—that is the modification into which its energy may be transformed—are therefore those of *degree* or force and *rate*. Massage is susceptible of specialization to the extent of the variability of its factors.

It is important that the adjustments of massage whereby contrary results of a curative nature are secured be clearly apprehended. To illustrate the principle stated, let it be supposed that the living body is composed of strata or layers from the surface inward. If compressed by the hand (as in massage), the anatomical parts immediately

beneath it become bound by the increase of adhesion into a uniform mass. The hand makes short motory excursions, and the whole mass moves with it, while the component parts fail to move upon each other. All molecular inter-motion is effectually prevented; no physiological effects of the transmitted motion are possible in the compressed area. The massage process reaches the stratum beyond where the diminution of compression permits the anatomical constituents to glide upon each other. Here, and *here only*, is the communicated energy converted into its physiological equivalents and uses.

It follows from this mechanical explanation that by dexterous application of the massage process its factors may be rendered available for any locality, whether superficial or deeply seated; and that for massage purposes the seats of important functions may be practically isolated, while other parts are in suspense and negation.

It is equally feasible to address massage to a specially *function-performing* tissue by adjustments of the methods so as to increase, or to diminish, its normal incitation. The activity of nutritive support of one function may be used as the means of withholding nutritive support from morbidly competing functions. Thus muscular power arising from nutritive incitation of muscle cells, or nervous power arising from appropriate nervous centers, may either of them be directed and nourished at will *at the expense of the*

are reversed. The nerve endings in the skin are *not traversed*, the skin moves along with and to the extent of the hand; more deeply seated anatomical structures are reached and the nutritive consequences inure to the advantage of the muscular structures and those associated therewith, while the nervous powers are in complete abeyance, functionally and nutritively. **Massage**, therefore, presents a practical method of solving one of the most difficult problems with which the physician is called upon to deal—namely, that of redressing the morbid relations of the two great energy-evolving tissues—the muscles and the nerves. This recourse has always been regarded as invaluable for increasing development of defective parts, and “gymnastics,” “Swedish movements,” “localized exercises,” are well-known means of securing this end. It is now seen that *by giving prominence and force to an isolable factor of massage*, similar results are secured in regard to *function-performing tissues* whereby ineffective function may be raised to its normal state, the relative excess of counterpoising function the same time corrected. In this way erroneous functions are remedially caused to acquire natural counterpoise indispensable to health.

The other property of massage susceptible of acquiring physiological preponderance, thereby therapeutic value, and which demands separate consideration, is that of *rate*. It is meant the number to the minute of motion

cursions or vibratory waves to which the vital parts are subjected by the massage process. *Rate* relates only to time, and is distinct from the extent of the motory excursion.

The question of the *rate* of massage processes is of leading importance, inasmuch as this factor largely determines the nature of the transformation of motor energy, and, consequently, the physiological effects superinduced. It has been shown above that, whether transmitted to or having its source within the vital organism, motor energy is resolved into its equivalents, and, besides, mechanical propulsion of fluids, abundant heat and chemical action are developed.

We are now prepared for the statement that the relations these secondary forms of energy sustain to each other depends largely on the *rate* of the process. The higher the rate, the greater the resolution into the chemical, and the less into the other forms of energy, and contrariwise. Convincing evidence of the correctness of this statement will subsequently be given. The practical conclusion is that while the *lower* rates or slow massage are efficient for promoting general nutrition and development, the higher rates of reciprocating action, or vibratory motion, are efficient in promoting the *chemical* phase of physiological activity. The one supplies nutritive ingredients to the vital cell, promotes respiration and circulates the blood, while the other applies

oxygen to organic uses, and resolves unstable ingredients into exit products; the higher the rate of massage (within certain ill-defined limits), the more searching and efficacious is this latter effect.

At this point the therapeutic world is confronted by an embarrassing lack of experience and knowledge; for other rates than those natural for the hand of an operator to supply are scarcely conceived. The vast outlying area, both above and below the narrow line of human capability, invites exploration.

The rates of manual massage are but very slightly, and at most but transiently, controlled by the operator or masseur, but by universal law. The limbs in action necessarily *beat time* as inevitably as the swing of a pendulum. This is because the predominating force engaged is *gravitation*; the constancy of this force ultimately compels the muscles to act synchronously with it, spite of opposition of the will. The operator quickens his actions at the expense of his motory and nervous resources; these failing, suspension of endeavor quickly follows. A quickened rate of manual massage defeats its purpose to communicate the motor form of energy; the action ceases before effects can rise to an appreciable extent.

Similarly, lower rates than those fixed by natural law are difficult to execute by the operator because of the control of the same law; an

the operator's resources may be prolonged, the process is brought to an early and generally ineffective end, for unnaturally slow motions require fatiguing restraint by the will and superinduce nervous depression, and effort is thereupon suspended.

The actual time-rate of the extremities in ordinary, well-sustained occupations is not, in general, far removed from that of a pendulum beating seconds, and accords with the rhythm of the arterial system. Extreme deviations from such rates are necessarily transient. When, therefore, a masseur writes or talks about his practice of more rapid rates, it is in depreciation of the value of his performance. He is powerless to surmount Nature's barriers in the way assumed.

These considerations naturally lead to inquiries respecting the vast outlying field of rates and degrees of motor energy, extending below and above the narrow scope of the operator. It is interesting to inquire whether in this limitless extension there be rates of motor energy which are legitimately of medical service. Any desired extension of scope of motor energy is attainable by the aid of mechanical adaptations and contrivances. In the pursuit of this purpose science affords close analogies, for, by the aid of mechanical contrivances, the universe has been enormously extended and unfolded to our observation and its exploration goes on. We have been shown that what to our senses are the far differ-

ing phenomena of light, heat, electricity, motion, and other forms of energy, are but variations of *rate* and *degree* of essentially the same thing—differing forms and conditions, *modified* by *material agents*, of wave-like or vibratory motions. By the aid of appropriate apparatus, we may also investigate the consequences of vibratory or wave-like motions, at their different rates, when transmitted to the complex components, vital and non-vital of the organism, and learn what we may of the laws governing this procedure and the objects attainable thereby—matters which are as a sealed book to those whose observations have been limited to the degrees and rates of motor energy which emanate from the masseur.

We may next turn attention to the physiological and remedial effects of massage whose rates are *below* those of which the human hand is capable; and to the adaptation of these to special forms of disease of the abdominal and pelvic contents.

THERAPEUTICS OF SLOW MASSAGE.

—
AUTO-MASSAGE—KNEADING.
—

THE vital organism is never motionless in its quietest moments. Its different parts and organs are constantly pervaded by spontaneous and unconscious wave-like motions. This is especially and conspicuously true of the contents of the trunk and pelvic cavities—the visceral organs. These motions inhere in the mechanical structures which dominate the parts referred to; and so important are they to the welfare of the vital organism that Nature has rendered them mostly independent of the intelligence, will, and the senses, which are notoriously liable to err.

As the motions to be described are intimately associated with mechanical structures whose functions are maintained by other causes than those emanating from the reflective power, they may properly be called *auto-motions*; and since they may be shown to bear a close resemblance, in form, to the *imparted* motions known as massage, in being reciprocating or wave-like and susceptible of variations of *degree* and of *rate*, there is much propriety in classifying the differing grades and varieties of spontaneous motions

found in the vital organism under the common designation of *auto-massage*.

Auto-massage belongs decidedly to the *slow* variety of massage processes—that is, its rates of motion are at and below those which the hand of an operator can naturally and easily execute. This is readily seen from the fact that auto-massage appertains particularly to the *visceral* organs—the contents of the cavity of the trunk. Although some of the auto-motions have their source in the general muscular system and others in special motor mechanisms, yet the motions thus evolved appear to inure to the advantage of the organs contained in the cavities mentioned. This shows that the purposes of auto-massage are essentially the promotion of *nutritive* processes, of which the before-mentioned parts are the source and seat.

The contents of the cavities of the body are soft, yielding, and have a slippery exterior; they are therefore perfectly adapted to be moved and among each other, and to yield to the slightest mechanical impulses derived from external sources or generated in their own tissues.

Whatever the cause or the origin, all such motions necessarily have the qualities of *power* and *rate*, thus further justifying the designation of massage. We may now pass in review several auto-motions, and note separately their source, rates, purposes, and distinguishing characteristics.

Bodily Motions.—The ordinary activities of the average individual, whatever their purpose, necessitates the *bending, twisting*, and unending combinations of these movements of the trunk for exterior purposes. All such trunk movements produce mechanical effects—that is, expend motor energy among the visceral contents.

Some degree of compression, mild or severe, with displacement of organs, inevitably results. Similar mechanical consequences might be noted were a bag, of similar size and shape, compactly filled with loose objects, as balls, subjected to similar combinations of bending and twistings. The contained objects would be displaced; they would be subjected to alternations of pressure; the great extent of surface would glide or scrape against each other; and if composed of rubber, the elastic property would be fully brought into exercise, with its special result of heat development.

The gravitation—that is, weight—of the visceral mass causes far greater pressure at its inferior than its superior portions. Whether this difference of pressure be beneficial or prejudicial depends on circumstances which it is highly important for the therapist to weigh carefully. Difference of pressure is a factor of great significance and is easily turned to the highest therapeutic account.

In the present case a sharp bending of the trunk, say to the *right*, mechanically necessitates dimin-

ished, perhaps entire relief of, pressure at the opposite, or *left* inferior, portion of the contents of the cavity.

As regards the venous and lymphatic vessels, the act is one of suction, so called, and affords a direct and positive upward impulse to the contents of these vessels, which effect is repeated as often as the same or similar motions recur. The usual motions of the body, whether simple or compound, therefore superinduce auto-massage of the contents of the trunk, the mechanical consequences of which are naturally increased by the greater gravitation at its inferior part. The physiological effect of this form of auto-massage is the onward and upward movement of the fluids of the pelvis and abdomen and the outflow of interstitial juices. Such outflow is an indispensable preliminary to arterial inflow and to the renewal of local nutrition; the contents of the intercapillary spaces, whatever they may be, are drained into the portal and lymphatic vessels. Auto-massage superinduced by trunk motions has no special rate; it may, under full occupation in health, average ten per minute.

Rhythmic Motions of Respiration.—If an animal at rest be carefully inspected, it will be seen that the respiratory movement includes the diaphragm, the dominal wall, and that the inferior wall of the chest and the anterior of the abdomen act synchronously. The whole mass of the digestive organs is located between these boundaries,

consequently subjected to the oscillating motions of the respiratory acts and participates in its variations of *rate* and *degree*. Since this motion in the human species is approximately perpendicular it follows that it is attended by differences of gravitation, the difference being greatest when gravitation becomes greatest by reason of location; the upward part of the act removes pressure, while the downward part restores pressure to the lower portion of the visceral mass. Whatever circumstances may cause *deepening* of the respiratory act, extends the effort to the visceral contents in the form of increased difference of pressure; in other words, increased degree of the auto-massage of the abdominal and pelvic viscera. Respiratory auto-massage evidently includes all the hollow organs of the viscera—the stomach and the digestive canal to its inferior termination. It subjects their contents to the motions which tend to urge them on their course of contact with the interior surfaces of the canal. It causes the exterior surfaces of the different segments to glide upon each other. The secreting glands which line the walls are subjected to the same constant rhythmic changes of pressure, mechanically facilitating the discharge of secretions. The same oscillations of pressure impel the contents of absorbent vessels, and are a most important consideration in accounting for the acts of absorption. The same rhythmic changes of pressure applied to the venous and lymphatic

circulatory vessels manifestly exercise a controlling influence in the movements of the contents these vessels, an influence which experience shows can not be even partly dispensed with without serious damage to health. It is not only the chief agent for the transfer of the products of digestion to the blood-vessels, and the support of the system at large, but it is the efficient agent for maintaining the health of the inferior organs—those of the pelvis—by insuring their full and constant drainage under all adverse circumstances. The *rate* of this leading and constant form of auto-massage is fifteen to twenty per minute.

Locomotion.—If the top of the head of a person progressing over a level surface is observed, it will be seen to make a series of perpendicular oscillations, to the extent of from one to three inches, according to his rate of progress. The motion is superinduced by the *spring* he communicates to his body by the exertion of the muscles of feet and legs.

In this act the contents of the cavity of the trunk necessarily participate in the form of *auto-motion*, in which variations in gravitating force are produced, affecting the mass in general, and the contents of the vessels in particular, since all variations of vascular pressure indicate movement of vascular contents in the direction of least resistance.

If *ascent* is made in locomotion, as up stairs

or an acclivity, other factors are engaged in the act. Muscular energy to lift the body, far greater than that required to impel it over a level surface, is now added. This demand for voluntary motor energy requires more blood and more air from which oxygen is taken; these are supplied to the muscles through proportionate increase of both respiratory and locomotive auto-massage. The *degree* or force of the auto-motion increases first, afterward the *rate*, and both factors become conspicuous throughout the viscera. These obvious facts are conclusive evidence that the slow or kneading form of massage, whether supplied from exterior causes or automatic, is indissolubly associated with nutrition and is directly tributary thereto. The *rate* of locomotive massage is about the same as that of manual massage, being controlled by gravitation. The interesting fact should be noted that locomotion, temporarily hastened by the will increases its *degree*—that is, deepens its extent more than its rate.

The Circulatory System of Auto motions.—The heart and arteries are a very conspicuous field of auto-massage. The energy represented in motions of these vascular walls does not, however, extend into surrounding tissues, but is expended chiefly within the walls of the vessels, in the form of continued or untransformed motion, and in chemical changes, for which the *rate*, being quicker than the other forms of auto-

massage, renders it adapted, so that depurative effects become possible, even within the blood-vessels.

The Vermicular Motory Function of the Digestive Organs.—This form of auto-massage has, unfortunately, monopolized the attention which should have been distributed impartially among all the varieties above described. The consequence is, that faults are ascribed to the digestive canal which in reality belong somewhere else; that defects of its special movements are sought to be remedied by medicinal impressions of its interior, which are due from other sources. The natural and wholesome incitants of digestive organs arise exteriorly. The vermicular motion requires the mechanical impressions naturally supplied by the combined automotory processes, which have been described, as its incitant. The substitution of drugs whose influence is confined mainly to the digestive tract practically withdraws the normal incitant. The consequence, as all who have much experience know, is that the power of the several forms of auto-massage declines, and the digestive tube and appendages no longer receive due motory incitation of auto-massage; the interior or drug incitation is substituted.

The reasonableness of dependence of the vermicular upon the other forms of auto-massage is shown by the following physiological considerations: Digestion, and the consequent dis-

charge of digestive residuals, is naturally proportioned to, and largely dependent on, muscular expenditures, of which auto-massage constitutes no small share. The occasion or necessity for vermicular action, therefore, only exceptionally arises from interior incitation, but from that afforded exterior to the organs in which it is developed. The vermicular function is thus superinduced by its purposes.

When, therefore, this action is superinduced by drugs, the nutritive purpose suffers defeat, for ingredients destined for the support of vital powers are by this means consigned to the category of useless residuals and lost, to the obvious detriment of the auto-functions from which normal incitation of vermicular massage is due.

The due maintenance of the auto-muscular functions of the digestive apparatus is highly important, as is shown by the following considerations: The discharge from the organism of residuals of digestion is a comparatively subordinate purpose of its auto-motions, inasmuch as the *quantity* discharged is far inferior to that absorbed. Absorption is therefore the greater purpose, and this is defeated by drug incitation of the auto motion, but secured by natural or massage incitation.

Other purposes of vermicular action arising from its legitimate incitants—the mechanical aid to the secretions, especially from the pancreas and liver; mechanical assistance for local venous and lymphatic vessels, and the due maintenance

of the nutrition of the muscular coats digestive apparatus, which is secured, their proper, not by forced, exercise—a parent.

It is important to note that the vern function of the digestive canal responds to *slow* mechanical impressions, and not to the rapid rates. The normal incitants pointer have conspicuously slow rates of motion; quicker motions are therefore incapable of mingling with these to re-enforce their power to control the vermicular act. Although the transmission of massage at rapid rate to the visceral organs is frequently indicated by the nature of the disease requiring this form of remedy, yet in this case the vermicular function is restrained and not increased by motory processes exceeding the rate of normal auto-massage.

The considerations above presented show that structure and function are conjoined in the organism to render indispensable certain slow auto-motory processes; that these are normally communicated in the form of deep waves through the visceral organs; that these have adequate motory sources, independent of the influence of the will; and that the physiological necessity for this class of activities is asserted by the multiple provision within the organism for securing the same.

In considering the proposition to supply by artificial means the defects of natural or auto-massage, it is

essential that the characteristics of the latter be particularly noted, for therapeutic success must depend on compliance with the demands indicated by the auto-process.

The special field of auto-motions is evidently comprised within the cavity of the trunk, or cavities, if the pelvic be regarded as mechanically distinct from the abdominal.

The *rates* of the auto-processes extend from that of the limbs (governed by gravitation) to those indicated by the single numerals per minute, rates which can not be effectively maintained by manual methods.

The *degree*, depth, or force of auto-massage is sufficient to include the whole visceral mass.

The *scope* includes visceral organs and excludes the surface, and, indeed, all parts highly endowed with sensory nerves.

The *mode of action* of auto-processes of massage is the production of differences of pressure in different portions of the visceral mass and the vessels therewith connected.

The *effect* or consequence of difference of compression of different parts, including both solids and fluids of the viscera, is to urge whatever is subjected thereto in the direction of the less pressure.

The *direction* in which this auto-motory cause acts as a whole is *vertically*, or, in opposition to gravitation. The differences of pressure also cause *gliding* of distinct organs and parts upon each other in obedience to variations of pressure.

The direct mechanical consequences are complete drainage of the visceral mass of all superfluous fluids and the rendering of local stasis and its morbid effects impossible.

The same mechanical cause also obviates undue and prolonged contact of organs and parts of organs with each other, and of viscera with the containing abdominal walls, and of inferior loops of digestive viscera with those of the pelvis.

The *therapeutic consequences* of the above-stated mechanical effects of auto-massage, and of any massage which approximates it in form rate and degree, can not be over-estimated, for thereby is solved its most difficult problems; for not only is the origin of a variety of morbid manifestations clearly demonstrable, but the way is suggested for not only obviating the maladies, medical and surgical, which depend thereon, but also of extending the scope of such means to include the well-developed morbid consequences.

The above-stated fundamental principles are confirmed by comparative physiology. The visceral organs of four-footed creatures are mechanically poised between anterior and posterior supports, and thereby subjected to the extreme mechanical effects of the motion of the limbs in all their varieties of pace. The consequence is auto-massage of viscera more constant and far exceeding that possible in the human subject. There is perpendicular oscillation of great weight, sectional compression, pressure-gliding, and rubbing

from unequal displacement of organs; great extremes in degree, though uniformly slow rates of auto-motion, and almost entire immunity from the digestive and pelvic ills to which the human species is notoriously subject.

This illustration is an object lesson in physiology, establishing an indisputable point of ætiology, for faults of motion (which is really function) when prolonged, develop consequences in the tissues entitled to special designations, defining local and sensorial characteristics.

It hence appears that the conversion of a pathological condition into the physiological consists essentially in *restoring function*—that is, in re-establishing in full force the agency by which health is maintained. In case of chronic suffering of the visceral organs, slow auto-motions are the fundamental factor of their functions, and means are to be sought which serve to raise these to their normal degree.

The *causes* of the decline of the auto-motory functions have in part been shown, but for clearness may be restated. The fundamental cause lies in physiological habits unconsciously faulty; for it is hardly supposable that rational beings will deliberately and consciously cause their powers, and therefore the sum of their enjoyments, to diminish. The advantages of civilization are thus far accompanied by serious disadvantages and drawbacks arising from misdirection and perversion of the senses, the subordination of the

judgment to this faulty influence, and the increase of these defects through heredity.

While the vocations of large numbers afford sufficient, often an excess of exercise, this is liable to be partial and physiologically misdirected; and such persons suffer from disorders of visceral parts scarcely less than those whose exercises are insufficient. In both cases the trunk-motions react on the viscera with insufficient mechanical force, and there is consequent marked immobility of the intestinal convolutions and stasis of the visceral circulation. An intestinal fold or knuckle impinges with continuous, instead of the natural interrupted, pressure against some point at the lower border of the abdomen, thinning its walls and causing protrusion at the slightest provocation, or it intrudes upon the sacred rights of the female generative intestine, insinuating behind this, before that, between other parts, urging them aside and dislocating them. The same immobility prevents the full return of the circulating fluids for aeration, re-enrichment of ingredients and redistribution, allowing them to stagnate in vascular pockets, and in parts least subjected to auto-massage and finally to ripen into local disease.

These statements bring into view two distinct conceptions of the nature of chronic affections of the visceral organs. These may be distinguished as the *nosological* and the *etiological* conceptions. The *nosological* has its basis in

variability of manifestation. It emphasizes the common, distinctly defined morbid appearances, notes the results of exploration, and lays special stress on the disagreeable sensations—*consequences* of defective functioning. Any point from stomach to rectum may serve as a locality; the specific manifestation may be any secreting process from the liver to the minutest follicle; and hyperæmia and consequent tissue change, and hyperplasia and degradation of interstitial ingredients, morbid discharges, abscesses, ulcerations and pain, become objective purposes for medical combat.

The *ætiological* conception fully appreciates these and a multitude of other objective features of disease, but it regards them as products in a state of incompleteness. They are evidences of *inadequate functioning* and are rendered impossible in proportion as functioning approaches completeness. The physical energies of the organism fundamental to functioning processes are ill-developed and misapplied.

The therapeutic purposes under these different conceptions of pathology also differ radically. In the one case remedial measures are adjusted to the apparent local requirement, to suspend pain, to relieve local hyperæmia, to oppose mechanical dislocation of parts by direct local mechanical obstruction, and to give vent to confined fluids.

The other mode of considering the pathology leads to supplying the lacking physical energy in

kind, rate and degree, approximating as near as possible those which naturally appertain to the suffering viscera. This class of measures are not substitutes for auto-massage, but serve to cultivate the non-sensory powers of the visceral organs and the mechanism intimately related to visceral functions. In this way a permanent increase of their spontaneity of action is secured. The correctness and therapeutic value of this statement invite the most rigid and critical tests. These are afforded by simply supplying massage of the *slow* and *deep* variety to the suffering viscera. This recourse is commended by being normal to the tissues and organs, and no higher or more cogent justification is conceivable.

The adjustment of massage to visceral organs requires conformity to anatomical as well as physiological peculiarities. The supplied process should, as nearly as possible, resemble the autogenic process in the particulars of *rate, degree, location, position* of body, and whatever circumstances conduce to natural or physiological effects.

Slow massage of visceral organs is popularly known by the term *kneading*, from its resemblance to that well-understood practice, and will be more convenient to use this term in describing the details necessary in the process. The nature of the adjustments required to comply with therapeutic purposes has been, in the main, indicated, but may here be recapitulated :

The *rate* at which abdominal kneading best complies with therapeutic requirements is found by experience to be about twenty-five impulsions or wave-motions a minute. This rate, it will be noted, is about the average of the different motions propagated through the viscera in health, proceeding from the respiratory mechanism, from bodily motions, from locomotion and other motory stimuli which co-operate to impress the digestive and the pelvic systems of organs as masses of substance pervaded by fluids having a predestined onflow. It is necessary here to state what will subsequently be explained in detail, that quick or vibratory motions can not practically be substituted for the slow variety when the effects of the latter are desired, since the former exercise control of another department of nutritive processes at variance with the purposes of kneading.

The *degree* or force of the transmitted motor impressions should be sufficient to include the whole visceral mass in the motory wave. This mass is largely continuous anatomically, and the motory impulsion should extend to all parts of the portal vein and its branches and to the whole visceral lymphatic system. Interstitial absorption of all fluids of whatever character and their submission to the chemistry of the organism is the direct consequence. Superficial motory impressions are useless for this purpose, and are in other ways possibly injurious.

The posture of the patient during the kneading

process should be that of *lying face downward*, so that the mechanical impulse shall be from beneath the visceral mass. The reasons for this position may be readily understood. Nature enforces the action in this position throughout the world of inferior animals—an evidence that the desired effects are thus best secured. The backward-lying position is excluded because pressure of the abdomen in this position forces its contents toward the pelvic end of the cavity, producing mechanical effects it is desirable to remove, obstructing the flow of the venous and lymphatic vessels, impacting the organs, preventing their natural intermobility, wedging the intestinal folds against the lower part of the abdominal wall, and insinuating them among the pelvic contents, narrowing and mechanically obstructing the alimentary canals. These consequences are aggravations of pre-existing difficulties for which remedies are sought.

Exactly opposite effects flow from kneading the abdomen in a reversed posture—that is, face downward—as is clearly shown by the aid of the illustrations and descriptions following :

The *posture* of the body required for effective kneading renders its manual application impracticable. Not only is the *rate* of auto-massage which requires to be re-enforced too slow to become merged with manual rates, but the abdomen of the patient in the required position is practically inaccessible for a manual process ; be-

sides, the *time* during which the process should be continued at each *séance* is longer than meets the approval of the manual operator. The *patient* is the sole judge of the agreeable and the disagreeable in the process, and is, therefore, solely competent to adjust the process to his feelings. This principle excludes the manual method, controlled at haphazard or by some pet theory of the masseur.

Apparatus for Kneading.—Three forms of apparatus may now be described, which are constructed with the purpose of complying with the requirements for the therapeutic efficacy of the process. That shown at Fig. 1 may be called the

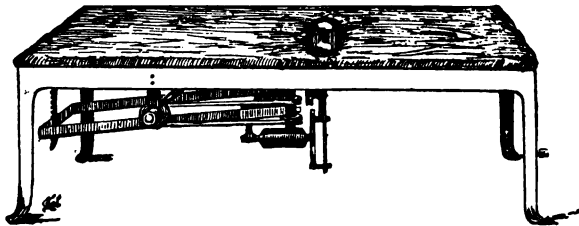


FIG. 1.

direct kneader. The patient lies at full length, face downward, upon it, exposing the abdomen through a broad opening in the upholstered top to the action of the mechanism. The purpose is to give slow vertical, oscillating motion to the visceral mass. This is effected by the alternate impingement of two broad kneading heads, acting at right angles to the abdominal exterior at its

two sides. By means of a suitable lever and ratchet the patient regulates the degree of the impingement so as to make it agreeable to his feelings. By slightly turning and moving his body he also instinctively still further secures adjustment. This apparatus is particularly efficacious in cultivating the vermicular, auto-motor functions of the digestive canal in all its parts.

Fig. 2 shows the revolving form of kneading apparatus. The couch, with a wide opening at its central portion, amply upholstered, on which

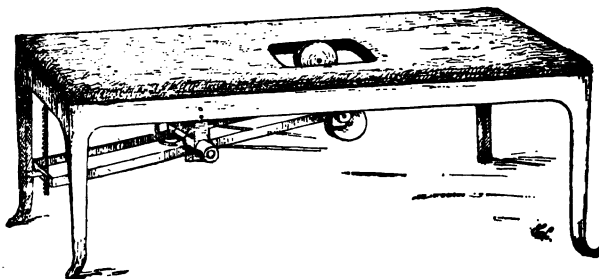


FIG. 2.

the patient may comfortably lie, face downward, resembles that shown at Fig. 1. The impinging part consists of two thick rollers, whose axis are at the ends of an arm extending through a revolving shaft, to which the rollers are eccentric.

At each revolution of the shaft these rollers engage the soft overlying abdomen, and urge the mass upward and forward, the two rollers acting alternately at its two sides. The practical effect

of the process is to shift the abdominal mass from the lower to the upper part of the abdominal cavity, and not only to remove abdominal pressure from the contents of the pelvic cavity, but even to cause these to recede as far as their attachments will allow.

Fig. 3 shows the *rotating* kneader, which supplies conveniences for the application of the process identical with those before described. In this case a single ball or sphere is made to revolve horizontally in contact with the abdomen, its track being approximately over the course of the

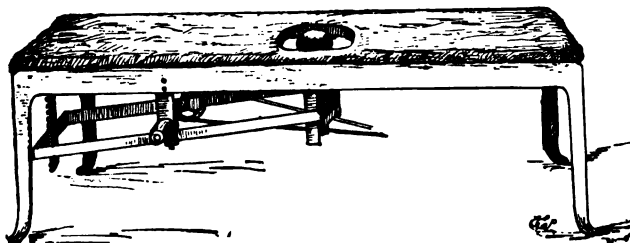


FIG. 3.

large intestine and in the direction of the natural course of its contents. The mechanical effect also extends to the whole mass of abdominal viscera, particularly affecting those parts usually regarded most at fault in case of constipation.

The advantages derivable from the mechanism above shown may be briefly recapitulated :

The position of the trunk and the unsupported abdomen conjoin in causing the contents of the

MECHANICAL AIDS IN

the cavity, including those of the pelvis, to re-
move from their location and rise to a higher point
in the cavity.

This position compels the patient's arms to be
extended laterally and upward; the muscular
connection subjects the upper portion of the
cavity to the widest possible distention, and thus
provides space into which the abdominal mass
passes.

The impingement of the acting part of the
apparatus narrows the lower part of the abdomi-
nal space, and urges the mass *from* the pelvis.

The apparatus shown at Fig. 2 causes *posi-
tive, forcible traction* from the pelvis, without
in the least impinging upon any part of its con-
tents. The transfer upward of the abdominal
contents causes those of the pelvis to recede in
the same direction, to fill the space that other-
wise would become vacant, aided by atmospheric
pressure; in this way all causes of dislocation
are removed, even though adhesions from pre-
vious inflammation have long existed.

The above-shown kneading processes act
through the abdominal wall, as one's hand
might afford a similar impulsion to the loose
contents of a bag.

It is plain that all the muscles of the abdomi-
nal wall are, by the kneading process, subjected
means best adapted to promote their nutrition,
development, and resumption of their natural
rhythm in the auto-massage of the visceral mass.

The most constant and satisfactory evidence of ill-health is this auto-function; the most constant concomitant of ill-health are its defects, for these produce, whenever long continued, to abdominal (digestive) and to pelvic manifestations of disease.

whole cavity, including those of the pelvis, to *recede* from their location and rise to a higher point in the cavity.

This position compels the patient's arms to be extended laterally and upward; the muscular connection subjects the upper portion of the cavity to the widest possible distention, and thus provides space into which the abdominal mass passes.

The impingement of the acting part of the apparatus narrows the lower part of the abdominal space, and urges the mass *from* the pelvis.

The apparatus shown at Fig. 2 causes *positive, forcible traction* from the pelvis, without in the least impinging upon any part of its contents. The transfer upward of the abdominal contents causes those of the pelvis to recede in the same direction, to fill the space that otherwise would become vacant, aided by atmospheric pressure; in this way all causes of dislocation are removed, even though adhesions from previous inflammation have long existed.

The above-shown kneading processes act through the abdominal wall, as one's hand might afford a similar impulsion to the loose contents of a bag.

It is plain that all the muscles of the abdominal wall are, by the kneading process, subjected to means best adapted to promote their nutrition, development, and resumption of their natural agency in the auto-massage of the visceral mass.

RELATIONSHIP OF ...

The most ...
... is ...
...
...
...
...
...

THERAPEUTICS OF RAPID (MECHANICAL) MASSAGE.

THE prevailing idea that massage is necessarily manual in mode of application, and therefore limited to the motory resources of a masseur, is an error that has served to restrict the study of the most beneficent phases of this medical recourse. The chronic invalid, even the very feeble, has receptive capacity for rates of massage far beyond that of the medium and comparatively neutral scope of manual power. We have seen that rates of massage much *slower* than the hand can supply corresponds to certain spontaneous or auto-processes of the vital organism, and that these slow rates therefore comply with fundamental therapeutic requirements. But to secure the proper rate, and to adjust its applications to parts of the body difficult of access, mechanism is necessary. This shows that therapeutic advantages may be derived from sources which, without mechanism, are incapable of being even tested. The remedial capabilities of slow massage being thus rendered available in therapeutics, naturally suggests the possibilities which may lie hidden in untried higher rates of the same agent waiting to be tested, studied, and exposed to professional judgment and service.

Massage at rapid rates—those beyond the limits of the hand to execute—likewise requires the intervention of mechanism for the purpose of multiplying the *rate* of the motor processes. Mechanical adaptations are also required to adjust the applications to the different regions of the trunk and extremities, to adapt the degree of the force to special curative requirements, and to give instant control of the action, especially as regards degree, to the person to whom it is applied, for only by this provision can he always derive agreeable and no other sensations from the applications.

Quick massage is simply *vibration* of the fleshy mass receiving it, without reference to its form, degree, or source. The essential peculiarities of vibration are shortness of the linear extent of the motion, and the consequent frequent reversal of its direction. This causes very numerous *endings* of the motion, which returns over the same line. Vibration may be compared to the blows of an infinitesimal hammer, under continuous and very rapid action. To show the significance, physical and physiological, of this mode of delivering energy is the purpose of the present chapter.

Apparatus suitable for communicating vibration, quick massage, to the body and its parts, admits of considerable variety of form. The physical nature of flesh, ~~being soft, yielding and~~ elastic, permits vibratory waves to pervade its mass. The action is propagated in flesh as it is in fluids, and reaches all its innermost parts at

the same rates and in nearly equal degree. Such applications are by no means superficial. Structural parts, cells, membranes, fluids, whether interstitial or coursing in different directions in appropriate channels, vital organs and non-vital ingredients are pervaded alike by this agency.

The vibrations thus mechanically transmitted to the vital system are lost only in appearance, being, in fact, changed without loss to other forms of energy, and subject to identification by other tests than the direct senses. Both the vitalized and the non-vitalized ingredients encountered by this agent present fields for its transformation. As the motion of a meteor, on striking the atmosphere, becomes not only retarded but changed to its equivalents, so does the motion transmitted to tissues, on being retarded therein, become changed in *several* ways, according to the nature of the ingredients obstructing its pathway.

The study of the effects of vibration or quick massage becomes of interest from the following separate and distinct considerations:

It is of *scientific* interest to determine just what equivalent forms of energy arise in the vital organism under the different forms and rates of vibratory action, and what conditions, on the part of the organism, serve to promote, restrain, or modify its physical effects.

It is of *physiological* interest to determine whether the different classes of vital function may be increased, transposed or diminished

means of directing motor energy from outside sources to their respective vital organs. Also to determine whether such transformed energy is identical in form with that developed by the organism, and whether that arising from the two sources is capable of becoming merged and physiologically undistinguishable.

And it is of high *medical* interest to determine the *consequences* of the effects of vibration above suggested in pathological states of the organism, the therapeutic values derivable therefrom, and the conditions and cautions necessary for rendering such therapeutic influences practical.

It hence appears that a wide and almost virgin field for exploration is opened by the proposition to subject the vital organism and its non-vital constituents, its diverse functioning activities, and its varied incorporated and spontaneous chemical tendencies, to the influences flowing from transmitted vibration.

The difficulties which this study has presented have arisen chiefly from the fact that the inquirer is very apt to seize upon some *one* effect or fact, and neglect others even more worthy his attention. It shall be my endeavor to place before the reader such facts as seem to establish *principles* available for the physician. The nature of the case does not permit of a strictly scientific order in the arrangement of the subject; the topics embraced therein will therefore be presented in the order of the presumed interest of the inquirer.

1

Vibration as an Anæsthetic.—This agent is somewhat known as a means for securing the suspension of pain, and even for permanently removing chronic neuralgic affections which have proved intractable to other remedies. Notwithstanding the well-proved efficacy of this agent, its restricted use for this purpose is easily accounted for by the fact that facilities for its proper administration are not usually at hand, and the necessary practical details are unfamiliar to the physician. Most physicians have seen references to the efficacy of this agent in their reading, especially of English medical periodicals of a dozen years ago. In these days of prevalence of neuralgic disorders and of much seeking of remedies adapted to ameliorate if not to obviate pain, this effect of vibration is entitled to renewed consideration, and a just estimate of its nature and value should be acquired. Is this special remedial effect temporary or permanent? Is it to be classified with the so-called sedatives, or with some heretofore imperfectly investigated class of remedies?

Different investigators have arrived at radically opposite conclusions respecting the remedial effects of vibration in painful nervous disorders. Some have accepted the easily demonstrated fact as a fundamental principle; others regard suspension and even the radical cure of pain as secondary and dependent on certain changes superinduced in the ordinary physiological activities, which are neglected by the sedative-

seeking inquirers. These differences are doubtless due to prepossession of opinions or their absence on the part of the investigator. Experimenters are apt to find what they are seeking, especially when the search is obscure. Very much depends on the kind of instruments employed, and their adaptation to determine the facts sought.

A better understanding of this interesting subject may be attained by bringing forward some of its historic as well as its scientific particulars. Medical literature is indebted to Dr. J. Mortimer Granville, of London, England, for setting forth his experience and conclusions in a book published in 1884, entitled *Nerve Vibration and Excitation, or Stimulating Percussion for Functional Nervous Disorders*. The applications are described as light, rapid blows of a *percuteur*—a small hammer with an ivory point, which, under the reciprocating motion imparted to it, transmitted vibratory action to the skin and flesh underneath. The operator's hand was evidently the source of power in the earlier experiments, but irregularities of rate and degree, and the very limited time it was possible to sustain the action, rendered the effects uncertain, and so clockwork mechanism, operated by a spring, was substituted. The apparatus while in action was moved about upon and near the painful region, and therefore communicated rapid waves of vibration to the flesh underneath. There is no

statement of the vibratory *rate*. The action was frequently interrupted by necessity for rewinding the machine, and irregular from the varying force of the spring. A small electro-motor was, in a few instances, substituted for the spring, but no hint of its superiority appears, or that the conclusions previously made were in any way modified by this motor recourse.

The purpose in view in these vibratory applications was avowedly the single one of *arresting pain*. There was absence of expectation of other effects, and such others as necessarily accompanied the suppression of pain were quietly ignored. A long array of cases of neuralgic and other painful chronic affections, successfully treated by vibration, are given in support of the claim for the therapeutic power and efficacy of this agent.

Dr. Granville engaged the attention of several physicians of eminence, among them Sir Hugh Campbell, who repeated the experiments, apparently without attempting any variations, and in confirmation to Dr. Granville's views. At about the same time similar experiments were made by M. Boudet and M. Vigoureux, of Lyons, who also arrived at the same conclusion; not, however, without a vigorous dispute as to priority of discovery, or what was regarded as a remedial application. The readers of the medical literature current in the more recent years ago will doubtless remember the details of these discussions. Most

remarkable is the unanimity with which these inquirers *excluded* all consideration of other effects of the agent whose powers they examined, except the single one of suspending *pain*. They did not even intimate that sensations of an *agreeable* kind are also suspended by the same agent.

The above statements respecting the control of pain in chronic affections by proper applications of vibration (or quick massage) are fully supported by my personal experience in employing this agent for the class of invalids mentioned. This experience, it is due to say, has unquestionably been more extended and varied than those which have above been referred to. This statement will, I hope, be sufficient justification for presenting facts additional to those with which the medical profession is most familiar, and which lead to far different as well as broader conclusions respecting the nature and effects of the agent under discussion.

Dr. Granville and his associates adopted a theory respecting the nature and effect of vibration which is best explained in words quoted from his book, written for this purpose. He says: "All nerve action is vibratile . . . the neuralgic state consists essentially in an abnormal set or series of vibrations into which the nerve has been thrown, perhaps by cold, or a mechanical or chemical irritant. This state may be changed by mechanical vibrations, propagated to the nerve sheath and its contents." Again,

"we deal with the nerve and *not* with its surroundings"—an evident mechanical impossibility. "No force is communicated by the hammer of the *percuteur*." What, then, is communicated? "The sole effect of vibration is to excite the centers and call out their potential energy, converting it into kinetic force. It can act only through the nerves." "Vibration, artificially supplied, introduces discord into the rhythm of the morbid vibrations of the painful state, and a change that brings relief," etc. Dr. Granville's subsequent difficulties in securing the desired relief of pain by this means ought to have shaken his faith in the theory, for he says: "Great care and tact are necessary in treating pain by vibration." "By continuing the process too long, *painful* vibrations may be set up;" hence directions are given to approach the painful region *slowly*, first subjecting non-painful, contiguous parts to the process—details of cases being given in which the non-success of previous treatment was changed to success by adopting this change of method.

If these investigators had reflected that it is physically impossible to vibrate nerve tissue separately from its surroundings; that the *other* tissues and the fluids included in a fleshy mass exceed, according to trustworthy authorities, by a *hundredfold* that of the nerve filaments it includes; and, further, that the fluid and solid, organized and unorganized, vitalized and non-

vitalized, contents of the mass include ingredients strongly predisposed to chemical changes—that, in fact, such changes, either normal in consonance of physiological purposes or in opposition to those purposes are inevitable—these factors would undoubtedly have influenced their conclusions.

Historical accuracy, the curiosity of the reader, and possibly justice, unite in requiring that certain *dates* be here recorded. In a correspondence, claiming priority over Dr. Boudet and the French claimants of the “discovery” of the pain-relieving power of vibration, Dr. Granville says: “As a matter of fact, nerve vibration by percussion with instruments furnished by myself was tried at the National Hospital, in Queen Square, London, in January and February, 1878, these trials having been led up to by previous experiments by less satisfactory methods.”

My personal investigations of the destiny of vibration in the vital organism, and the physiological and therapeutic effects flowing from this agency, assumed practical forms in 1864-'68, and very soon led to diversifying the mechanism whereby the effects may be varied and duly tested. The conclusions drawn from my experience were embodied in my article in the November, 1869, number of the *New York Medical Journal*, entitled “Inquiries Relating to the Therapeutic Effects and Uses of Vibratory Motion.” The succeeding March number of the same journal contained a second article, a sequel

to the above, entitled "On the Use and Force as Vibratory Motion in the Treatment of Diseases of the Nerves." My book, bearing a title nearly identical with that of Dr. Granville's book, was published in 1870.

The foregoing account of transatlantic experiments determining the anæsthetic effects of vibration proves the detrimental influence of preconceived theory in the recognition and appreciation of facts. The experimenters, in discovering what they sought, neglected to observe facts of even greater importance. No evidence is shown that nerve energy is vibratory in its development or transmission; or that, if vibratory, such form of action bears any relation to that of any mechanism. No allusion is made to ultimate nutritive sources of nervous energy; to its possible deterioration from nutritive faults; to the consequences of imperfect *denutrition*, for nutritive waste is even more liable to defects which react on the sensorial powers than nutritive supply; of suffering caused by maldistribution, as well as from faulty development of nervous powers; of impressions of the consciousness from general and local excess, as well as from insufficiency of nervous energy—all of which are topics inseparable from that of pain, its modifications, suspension and remedies.

My purpose in devising means for subjecting the organism and its parts to vibration was less that of subduing pain than that of reaching the

nutritive sources of pain by an adequate remedy. It seemed to me that the disagreeable and the painful impressions of the consciousness which invalids experience *may be legitimate*, denoting either faults of nutrition in the parts to which the undesirable sensation is referred, or obstacles in the line of sensory conduction. It is also notable that *pain* is intimately connected with appreciable defects of the other forms of energy which the vital organism coincidentally develops, all of which depend on nutritive processes as their sources. True remedies therefore must extend to the fundamental seat of energy, to the tissues wherein its distinctive forms are assumed. It follows that to correct morbid impressions in the seat of the consciousness, it is essential to rectify the nutritive source whence they spring, which, as we all know, may or may not be in nervous tissues.

Now, nutritive acts necessarily include two considerations, both of which are equally involved in the consummation of the nutritive purpose, whatever the function or the tissue concerned in the nutrition may be as a whole. Nutrition implies the supply of ingredients *to*, and the removal of the same *from*, the local point at which energy is evolved or other purposes complied with. Nutrition is far from consisting of accumulation of substances, vital or otherwise; it implies an equal amount of outflow or *denutrition*. The first is largely associated with

motor physics; for the latter, *chemico*-physics are indispensable. The supply and convoy of ingredients to the vital arena are of no account, while the changes due their elemental constitution are unprovided for. In fact, the controlling phase of nutritive purpose is the *denutritive*, chemico-physical excluding process. Now, since the energy for conducting these indispensable factors of nutrition is in health developed *within* the organism, and since defects of health are manifested in these factors, the suggestion of re-enforcing them by direct supply of energy from exterior sources when their insufficiency becomes apparant arose very naturally.

This suggestion is strengthened by direct experiment which any one commanding sufficient manual dexterity may repeat and verify. By widely separating the fingers of the right hand so that when a smart blow is given the stroke of each finger falls distinctly separate, the *rate* of the impact or percussion is quadrupled, and vibratory waves are made to prevade any fleshy part subjected to the process and may be felt at its opposite side. In a proper case for vibratory treatment not only is pain abated, but the accompanying soreness and swelling also. On account, however, of the impossibility of *sustaining* the required rate of motion, the recourse described is impracticable.

Two direct effects of vibration serve to explain the salutary consequences of its application to the

vital organism. One of these is the contribution it affords in aid of the defective *motor* physics of the physiological system ; the other is the ready and abundant contribution it brings in support of the *chemico*-physics of the organism whenever this department of physiology is faulty—a department whose defects are the chief concern of the average therapist.

How the mechanical or motory purpose is served by vibration is so obvious, even to the superficial inquirer, that but little explanation is required. The motor energy communicated from the exterior travels *as such* in the fleshy parts. But flesh is pervaded by conduits streaming with fluids (blood) in directions predestined by the mechanism of organization. The local aspect of chronic disease is marked by areas of *detention* of these fluids, by local mechanical obstructions, and by defective operation of the cause to which the outflow of these fluids is due. Now, *vibration* affords a succession of impulses *direct* to the contents of the vessels, urging them forward in the several directions required, thus becoming an effective auxiliary to pre-existing causes of the circulation. The same cause also restores the natural contractile powers of the circulatory vessels, and these causes unite in impelling forward whatever mechanical obstacles these motory defects may have superinduced, or which previously existed.

The consequences of outflow of the contents of obstructed vessels are immediately apparent in

surrounding parts. Fluids of whatever quality, normal interstitial juices and those loaded with morbid materials, return directly to the venous vessels to become resubjected to the corrective chemistry of the organism as a whole.

Important as these effects may be considered therapeutically, they are in reality the least of those superinduced by vibration.

These experiments and observations were begun in 1862-'63, and soon led to others through amplified means and diversified methods. The physiological inquirer is not content with generalizations; he insists on specific tests for the facts he seeks. He submits each tissue, secretion, function, or other object of investigation to separate and to conjoint experiment, and thus assures himself of the circumstances which influence the behavior of each part and of each to all. The mechanical scope of the human hand was evidently too restricted, and incapable of bringing further facts to light; its narrow field has been occupied and understood for ages, and is comprised largely of motor physics. What other important relations of therapeutic significance might be opened by a survey for which mechanism is required remained to be developed.

The Mechanical Apparatus.—A proper investigation of the higher rates of motory energy or vibration requires apparatus capable of complying with the following particulars:

It should transmit vibration at variable but

known rates to any selected part of trunk and limbs.

It should impart this action in diversified forms.

It should be capable of limiting the action and its effects to designated parts while other parts are omitted.

It should be capable of confining its action to distinct classes of functioning tissues.

It should be operated by adequate and untiring sources of mechanical power.

In pursuance of these purposes above outlined, I constructed (1864-'65) the several pieces

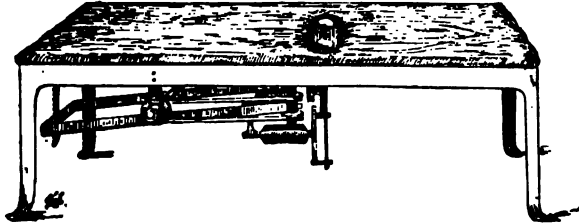


FIG. 1.

of apparatus shown below. The first (Fig. 1) imparted rapid alternating motion to two *percuteurs* in close proximity, which act upon any part exposed to them by means of necessary mechanism through an opening in the couch upon which the patient rests. The position of the patient is shifted at will, or as may be agreeable, and the *degree* of the impulse is controlled by the patient.

The *percuteurs* are set in action by a very

short crank, rapidly revolved by a multiplying wheel operated by a light motor or by hand or foot power .

The most effective rate for this and other forms of mechanism for similar purposes was found to be in the vicinity of a thousand waves or



Fig. 2.

strokes a minute. Diminution or entire suspension of pain was a pretty constant effect, provided the conditions before stated were complied with. The term then thought to afford a satisfactory explanation of this effect was *revulsion*, which referred to its mechanical rather than its physiological scope. Experience, however, brought to

light other reasons for considering this term a proper one.

Fig. 2 represents a form of apparatus made at this time in which the effect of impact or percussion upon the nerve centers through surface impressions is *wholly eliminated*. Even a much larger amount of motor energy may be transmitted than by the apparatus shown at Fig. 1, but entirely without percussion and the effects arising therefrom in either the reflex or the sensory nerves of the part. The nerves of the skin, and for a distance regulated at option beneath it, are neither impinged upon nor traversed in the application of this process. The apparatus imparts very short, perpendicular motory excursions to the fleshy mass compressed against a very soft elastic pad. The mechanical conditions are such that the pad *grasps* the flesh, which moves *as a whole*, while interaction of distinct anatomical parts is mainly prevented. The superficial nerves therefore wholly escape mechanical disturbance, and they convey no impressions to the nerve centers. Nervous irritability becomes suspended while the muscles, or at least their deeper portions, are subjected to passive motions in the direction of the axes of their fibers. In short, muscle action, and consequently muscle nutritive changes, are in this way incited in *opposition* to nerve incitation and its consequences. This effect is nearly the reverse of that caused by No. 1. For distinction, this consequence of this applica-

tion may be called *functional revulsion*. The evidence of this effect is shown by diminished or suspended pain and inclination to sleep, effects which increase day by day as the treatment is pursued.

This process may be extended to the arms and



Fig. 3.

legs as well as to all parts of the trunk, according to the requirements of the case, it being only necessary to turn the body and to adjust the height of the action to the part which is to receive it.

A similar process can be applied to the arms, legs, and even the trunk, by including either of

these parts *between two pads* to which reciprocating action is given. Fig. 3 shows the application to the arms of this form of vibration, the effects of which are intensified by *pressure*. The pressure is given by means of a lever under the hand of the patient and under instant control. Relaxation of pressure diminishes or suspends the ac-



Fig. 4.

tion. It is perfectly safe to leave the control to the option of the recipient, the feelings in this case being a safe guide. The double pads do not increase the rate, but insure contact of molecular constituents, and thus secure the transformation of motor to other forms of energy. In this case also the superficial endings of nerves are neither

traversed nor impinged upon, as in Fig. 1, but other functional processes are incited, to be subsequently explained.

Vibration is transmitted to parts of the organism by still another method, which may be called



Fig. 5.

oscillating, and is readily understood by reference to Fig. 4. A foot is snugly held by an appropriate device at the end of a shaft, which, by suitable mechanism, is made to oscillate on its axis. The bone of the leg, being practically a continuation of the shaft, participates in the same action

to which it in turn subjects the flesh and the fluids of the limb. A similar device (Fig. 5) applies to the hand and arm.

In this use and form of vibration (the same *rate* as before stated being preserved) both percussion and compression are eliminated. It follows that the effects of vibration are secured in such a manner that nervous impressions are entirely absent, and all nerve functions—either afferent, efferent, or central—are in abeyance.

The principal effects inure to the morphological elements, and especially to the chemical phase of all the constituents of the parts. Motor energy encounters various orders of resistance, compelling it to assume other and different forms.

The above are samples of many forms of apparatus devised by me at the period above referred to for transmitting motor energy in vibratory form to parts of the vital organism, and which enabled me not only to determine approximately what forms were assumed by it under different circumstances, but also what physical, physiological, and therapeutic effects were superinduced, as well as the positive and relative value of these effects in different pathological states.

The Chemico Physics of Vibration.—The foregoing description of apparatus affords a necessary preparation for understanding what is clearly the most important effect of the transmission of motor energy to the vital tissues, whether considered in its physical, physiological or therapeutic

aspect. For the attending conditions are such that the motor energy of the vibration is largely transformed to *chemical* activity, and results in elemental changes and transpositions of matter in conformity with physiological purposes.

These effects also accord with the purposes of therapeutics, especially in chronic cases. Cures are largely sought through remedies which have been proved by experience to re-enforce the chemical phase of physiological activity, or which naturally tend to increase this form of action. This ultimate principle appears whenever the operation of remedies in the cases referred to is fairly analyzed, and is sustained by experience, however empirical.

Pathology, whether its manifestations be general or local, is easily understood to have its source in some form of degree of *incompleteness* of the chemical phase of physiology. For it is only through this cause that injurious ingredients, tending to retrogression and to impair the vital structures and processes, can be retained by the vital organism to exert their destructive influence. And the correctness of this assumption is proved whenever the chemical phase of physiological activity is properly and judiciously promoted.

Primarily, vibration consists of very short motory excursions between two endings or turning points. The motory force is resisted by what ever it meets or collides with at these endings;

at these points the motor energy is imparted to whatever objects or ingredients may be present to receive it. Each distinct wave-ending is therefore comparable to the blow of a light hammer; and vibratory applications become the continuance of such infinitesimal blows, having the shortest possible intervening time. The energy expended at each impact is taken up by the atomic elements of the ingredients thus forced into intimate relations.

While blows of a hammer develop heat and rend cohesion, those of the *percuteur* and the other vibratory methods described are expended under radically different circumstances. The collision between ingredients of complex chemical constitution and of extreme instability is produced. The component atoms of these ingredients are very unlike in their nature, and are therefore receptive of the suddenly imposed energy in different degrees. The inevitable consequence is a destruction of the weak chemical equilibrium, and a new distribution of chemical affinities resulting in new compounds less unstable in chemical character. In short, the effect of vibration in vital structures is largely chemical, arising from the transformation of *motor* to *chemical* physics, and the reduction of unstable, therefore incomplete and injurious products, whatever their source in the organism, to physiologically completed and therefore normal and innocuous products which find immediate egress.

The school lecture-room affords abundant and apt illustrations of the principle above stated ; as when phosphorus is made to ignite when the motion of a rapidly revolving wheel, to whose periphery it is attached, is suddenly stopped ; and when gun-cotton, nitroglycerin, and many similar bodies are exploded by sudden arrest of motion or concussion, although, perhaps, capable of burning on being ignited in the ordinary way.

These are apt illustrations, derived from inorganic chemistry, of what occurs in the vital organism under similar conditions—namely, that forceful contact is even more provocative of chemical change than any other circumstances ; that the development of chemical energy is simultaneous with the disappearance of motor energy ; that unstable compounds subjected to chemical change from this cause are inevitably reduced to more stable forms ; that vital energy arises coincidentally with the passage of an unstable body from a state of *more* chemical energy to one of *less* ; that unstable ingredients, in becoming stable, are rendered indifferent, consequently innocuous ; that the vital endowment of matter in affording protection against the influence of chemico-physics is equivalent, for the time, to chemical stability ; and that vibration or concussion of elements secures the extreme degrees of chemical products contemplated in the physiological purposes

Turning to the vital organism, we find in it a

most admirable field for the physical processes and for insuring the physical consequences above indicated. Its components are exceedingly heterogeneous, and the differing classes of ingredients are largely diffused. The vitalized components are, for the instant, under protection of vitality. The non-vitalized are in various orderly stages of resolution. Everywhere are residual or *waiting* ingredients, and everywhere imperfectly and improperly employed materials in which chemical reduction is due and in which chemical change is inevitable. Whether such change be in the progressive physiological order, or become disorderly and deteriorative, is determined by the extent and the degree of the chemico-physics whose influence is brought to bear on the impending act. All components of the vital organism occupy stages of a career; all are passing forward to the next stage; and all are predestined to the chemical change which signalizes the evolution of either heat or other form of energy. Pathology is necessarily associated with imperfect fulfillment of the chemical change wherein energy is liberated for the advantage of the individual.

Oxygen, its Uses by the Vital System, and what determines its Consumption.—Of the oxygen, introduced by the respiratory process from the unlimited and ever-ready supply afforded by the atmosphere in which we dwell, just so much is taken in health as is required by the chemico-physics of the organism. Food of all kinds has

definite composition ; the completed products of its chemical change which pass from the vital system are also definite in composition, but increased by the exact amount of oxygen taken from the air of respiration.

The purposes of oxygen in the vital system thus become clear, and the consequences of its defective use by the vital system are intelligible, although the pathological states which the physician is called upon to correct are often referred to some intermediate circumstance which has little to do with the use or non-use by the vital system of oxygen. *Why* the system takes up less of this ingredient than is required to dispose of its waste and superfluous ingredients is seldom inquired. The pathology, which arises from faults of use being attributed to secondary causes, other than direct remedies are apt to be chosen for its correction.

There has, indeed, been a vast amount of experimenting based on the therapeutic need and artificial supply of oxygen, thus palpably connecting its defects with pathology. Among these devices is that of increasing its proportion in the air respired ; that of condensing by pressure the air for respiration ; that of liberating oxygen from chemicals in the air respired and in the digestive organs ; that of increasing the air space in the chest by developing its muscles, etc. These methods only promise increase of *supply to*, not *use by*, *the system* of this element—things very

different in practice. These devices all prove disappointing, not only because the supply thus afforded is necessarily temporary while the need is continuous, but more emphatically because *none* of these devices are capable of supplying the thing wanting—that degree of chemico-physical action which ensures the appropriation by the unstable residuals of the system of the oxygen which, though present, remains unappropriated.

Oxygen is appropriated at all points where heat of other form of energy is disengaged, because, under these circumstances, the systemic ingredients are passing into higher and usually into emergent forms of oxidation. It is clear that both motory physics and chemico-physics are required to secure the effect desired; the one to transport ingredients to the several points of use; the other to effect the forceful contact whereby motory is transformed to chemical energy by its transfer to the elementary constituents of the changing materials.

These effects arise spontaneously in health, and, though appearing to be causeless, are, in fact, intimately associated with the involuntary and the voluntary motory functions. The first have also the reciprocating form, and in the arterial department, which conveys oxygen on its being demanded, approaches the vibratory rate, while the voluntary motions seem to incite and perfect the involuntary.

The therapeutic uses of vibration consist, there-

fore, in securing such higher degrees of perfection in the faulty activities of the organism as shall remove the consequences of previous defective mechanico-physics and chemico-physics. The effects of applications of vibration extends primarily to the oxidizable ingredients, whatever be the name of the affection of which such ingredients are a fundamental factor. For reasons stated, those ingredients of the blood, interstitial fluids, and solids which possess the highest instability are the first to become destroyed on forcible contact with the oxygen which is always in readiness for this physiological purpose, and always effective when the conditions prescribed in the organic mechanism are complied with, whether these be classed as hygienic or remedial.

The substantial reason now appears why vibration allays pain and proves a trustworthy remedy in chronic neuralgias and other painful affections. This agent, by promoting physiological oxidation, removes the essential *cause* of pain, so far as this depends on impressions received by the nervous system from morbid environment. The pain is *not* the disease, local or general; it is the evidence of the presence of unstable ingredients, embarrassing nutrition, compromising the development of energy in other forms, defeating organic purposes, and affording timely warning of a severer fate. Pain is the disagreeable consciousness superinduced by these and similar physical circumstances. It is *these*, rather than th-

notification of their existence, which should be removed.

The vital system necessarily at all times contains *intermediate* products in various stages of progress toward the final goal of the physiologically perfected stage of oxidation, which stage is represented mainly by carbonic dioxide, water, urea, and salines. Faulty conditions diminish the degree attained by the oxidizing process; and the intermediate products, well known to chemical investigators, necessarily increase, and thereupon assume abnormal and morbid phases and strange chemical forms. The discharge from the system of the above-named perfected products is diminished, but their equivalents are retained in some noxious form, awaiting better conditions, which shall render them inoffensive.

If we may consider chronic neuralgia and other painful affections as resulting from the impressions the nerves and consciousness receive from the presence of adventitious ingredients inimical to vitality, the morbid condition may be understood by the term *auto-poisoning*, and bears an analogy to the poisoning arising from accumulation of oxidizable ingredients accidentally or willfully ingested. The effects of alcohol, opium, ether, and the alkaloids and sedatives in general will answer for illustration. Experience proves that the most trustworthy remedial recourse in these cases is to promote and to intensify physiological oxidation by maintaining the respiratory

process by every means available till the poison, if the dose be not too large, is neutralized by oxidation. The effect of vibration proves that the same principle is practically available for removing the cause of chronic neuralgic pains, and the rapidity and certainty of this effect indicates that oxidation, the cessation of pain, and the production of heat are synchronous in the part subjected to the process.

Other Physical Effects of Vibration and their Physiological Consequences ; Heat.—It is clearly provable by many conclusive tests that heat production is very much increased by vibratory applications. The glow of warmth produced in the skin, soon reaching the previously habitually cold extremities, affords satisfactory evidence of this effect. The temperature of the body, however, never rises above the normal standard, since the regulative powers, having their seat in the nervous system, are in effective operation. The increased heat becomes equally diffused ; in part because the circulation is also diffused, but in greater part because the process of heat development is no longer limited to the central parts, but is restored in normal degree to peripheral parts.

The rapid restoration of heat by vibration arises from two causes. One is the direct transformation of the motor energy to heat by *friction* of anatomical components of the organism—the fibers and membranes, down to the minutest

morphological ingredients, being compelled by motory waves, to glide with pressure upon each other—as when a piece of rubber is repeatedly stretched, or even rubbed, it becomes heated *without* chemical change. The other cause of heat arises from chemical acts arising from the increased consumption of oxygen.

The sources of heat are the muscle cells, whose rate of heat development is greatly quickened by vibration, even though the motor function be suspended, and also the non-vital fluids, which pervade all tissues. These contain unstable and highly oxidizable ingredients, which only wait a due impact or collision of elements to be rendered stable, and necessarily yield heat in the act.

The *evidences* of therapeutic oxidation are patent to the least scientific observer. These are of two kinds. One is the palpable increase of *completed* products of oxidation, whose emergence is due to the process. The urine becomes increased, assumes its natural odor and color, and ceases to yield a precipitate on cooling. This change is due to diminution of *extractives*, another word for the various products of defective oxidation. The quantity of watery vapor transpired and exhaled is likewise sensibly increased, as we know must happen, since water is part of the product of the resolution of the same ingredients that also afford the urea and carbon dioxide which is disengaged. The *other* class of

vidences consists of positive appeals to the senses. These are indications through the feelings and the muscular powers of returning health, the most significant of which is subsidence of pain and increase of volitional manifestations of energy, mental and physical. The mutuality of these relations appears to imply that pain is at the expense of the energy-evolving functions—that such energy requires guidance, not abatement or destruction; in short, that the central idea of remedying pain, legitimately, should be that of affording it more useful, and therefore agreeable, scope, through other than nervous channels of expenditure.

The principle of *transferring* manifestations of energy from one to another functioning seat, which I have above shown to be practicable, is invested with deep scientific and physiological interest, since it appears to open the way for radical change of therapeutic purposes. The desire to *suspend the consciousness* of disagreeable impressions, instead of abolishing their source, has greatly increased the number of drugs whose principal claim of merit is the possession of this power, which experience proves to be liable to enormous abuses. The practicability of changing painful to agreeable manifestations of nervous power by rectifying the nutritive source whence such powers emanate naturally supercedes, to the extent the method is practiced, the demand for drugs whose chief value lies in pre-

venting painful impressions from reaching the powers of the consciousness.

Vibration, aside from the mechanical and chemical physics it introduces, is, however, entirely capable of *suspending* pain and the sensory powers of any local portion of the body. This effect appears to arise from the fact that when a part is subjected to vibration, its sensory nerves, each and all, thereby receive *exactly the same* impression. No differences exist and none are perceptible. The discriminating power of the consciousness is therefore abolished, because the effect of impressions is abolished, and with it feeling, both agreeable and disagreeable, including local pain. The fact stated is easily proved to the most incredulous, who is at liberty to adopt other reasons than those assigned. The well-attested effects of what is called *hypnotism*, in respect to pain, may be susceptible of similar explanation. The vibratory subject does not, however, need to have a special susceptibility. It is probable that this incidental effect of vibration arrested and held the attention of the transatlantic investigators referred to in another part of this article.

We may now briefly review some of the physiological and therapeutic effects superinduced by quick or vibratory massage :

1. Vibration may be so applied as to impress the sensory nerves principally. This is when the impingement is on the skin. By this means the

MECHANICAL AIDS IN

tion of sensory nervous tissues, conductors centers, is increased, and therefore their duct of sensory nervous energy. This effect easily carried to a morbid degree, to the detriment of other functioning parts.

ibration may also be so applied as practically *mit* the nervous sensory tissues. In this case motory physics, but more especially the nico-physics, of the vital organism are increased, while the excess of nerve nutrition and irregular, obstinate, excessive, and morbid manifestations of nervous power are thereby diminished and permanently remedied. This effect of vibration has extensive application in nervous affections and the chronic diseases which the usual accompaniments of nervous diseases.

The remedial effects of vibration are by no means restricted to functional diseases. Its chief use is in the motory and chemico-physics of the organism. The curative powers of this agent through reduction by oxygen of injurious ingredients which spontaneously arise from faults of it may be called motory hygiene, require periodical investigation by the inquirer, to be understood or entitled to belief.

ibration is not exercise, and since the will is engaged, causes no fatigue. The rate of motory motion is incompatible with muscular action, which requires a slower rate.

Vibration may be regarded as *specific* in all

chronic inflammations of whatever part of the organism, and whatever may be the morbid product developed therefrom.

The several effects of vibration which are conjoined in producing this remedial consequence may be noted. One is thorough *diffusion* of the circulation—increasing the amount of blood at will in any desired region of the body, and correspondingly diminishing it in other regions, especially in that suffering from inflammation. The caliber of the capillaries is increased and contracted, in compliance with the disposition of their contents. Another is the urging forward, *from* the affected region, the obstructive contents of capillary vessels, including both morbid, chemical and other materials, thereby allowing interstitial, effused materials to return to the circulation, and so to remove the swelling. A third effect is the submission of these morbid ingredients to the chemico-physics of the organism, while this function is exalted to high efficiency by the addition from motor energy. Intimately connected with these is the modification of pulse-rate. The rate is *never* quickened, and in all cases of abnormally high pulse the rate is diminished—in pulmonary affections to the extent of fifteen or twenty beats a minute, and often this effect becomes permanent.

LANE MEDICAL LIBRARY

and fine, this book should be returned on
before the date last stamped below.

--	--	--

U702 Taylor, G.H. 16956
T24 Mechanical aids.
1893

[illegible]

